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Annual Report Fiscal Year 1993

(July 1, 1992 - June 30, 1993)



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Hazardous Waste Research and Information Center

Annual Report Fiscal Year 1993

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Hazardous Waste Research and Information Center
One East Hazelwood Drive, Champaign, IL 61820
217/333-8940 FAX: 217/333-8944

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HWRIC's Mission

The Hazardous Waste Research and Information Center (HWRIC) was formed within the Illinois Department of Energy and Natural Resources (ENR) in 1984. HWRIC was charged with a mission to combine research and education; information collection, analysis and dissemination; and direct technical assistance to industry, agriculture, and communities. Working with industry to reduce waste at the source and to recycle those wastes that could not be reduced was also a priority. In September 1989 the signing of the Toxic Pollution Prevention Act (TPPA) formalized the Center's programs to include Research, Information Services, Industrial and Technical Assistance, Data Management and Laboratory Services. This Act (Public Act 86-914), which was amended in 1990 by Senate Bill 2253, expanded the Center's five programs to include a Pollution Prevention Program.

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None

Chapter VII: Future Directions and Needs

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List of Abbreviations

ATSDR = Agency for Toxic Substances and Disease Registry
BNRC = Board of Natural Resources and Conservation
Center = HWRIC
CERL = U.S. Army Corps of Engineers Construction Engineering Research Laboratory
CFCs = Chlorofluorocarbons
CICI = Chemical Industry Council of Illinois
CRC = Community Recycling Center
CTAP = Critical Trends Assessment Project
DCCA = Department of Commerce and Community Affairs
DMS = Data Management Section
DOH = Degree of Hazard
EBS = Electronic Blue Sheet
ENR = Department of Energy and Natural Resources
FDA = Food and Drug Administration
GIS = Geographical Information System
GRF = General Revenue Fund
GSAC = Governor's Science Advisory Committee
HML = Hazardous Materials Laboratory
HWRIC = Hazardous Waste Research and Information Center
ICPIC = International Cleaner Production Information Clearinghouse
ICP/MS = Inductively Coupled Plasma/Mass Spectrometer
IDOT = Illinois Department of Transportation
IEPA = Illinois Environmental Protection Agency
IES = Institute for Environmental Studies
IGIS = Illinois Geographic Information System
IIT = Illinois Institute of Technology
IMA = Illinois Manufacturers' Association
ISP = Information Services Program
ISU = Illinois State University
LAN = Local area network
LSP = Laboratory Services Program
LUSTs = Leaking Underground Storage Tanks
MOD = Mailing Outreach Database
MWRDGC = Metropolitan Water Reclamation District of Greater Chicago
NIF = Nature of Illinois Foundation
OMC = Outboard Marine Corporation
P² = Pollution prevention
PA = Public Act
PAP = Program Advisory Panel
PC = Personal computer
PCB = Polychlorinated biphenyls
PICs = Products of Incomplete Combustion
PIES = Pollution Prevention Information Exchange System
PIP = Partners in Prevention
PPIS = Pollution Prevention Incentives to States
PPM = Parts per Million
RCRA = Resource Conservation and Recovery Act
RL/QAO = Research Liaison/Quality Assurance Officer

RRT = Reduction and Recycling Technologies
RWASTE = Reduce Waste At Source 'Til Eliminated
SGS = State Geological Survey
SWS = State Water Survey
TPPA = Toxic Pollution Prevention Act
TRI = Toxic Release Inventory
TQM = Total Quality Management
USEPA = United States Environmental Protection Agency
UIUC = University of Illinois at Urbana-Champaign
UNEP = United Nations Environmental Programme
VIA = Valley Industrial Association
WES = U.S. Army Corps of Engineers Waterways Experiment Station
WRAS = Waste Reduction Advisory System
WRIBIN = Waste Reduction Information Bibliography Input Program
WRITE = Waste Reduction Innovative Technology Exchange

Chapter I: Introduction

The Hazardous Waste Research and Information Center (HWRIC) was formed within the Illinois Department of Energy and Natural Resources (ENR) in 1984. HWRIC became a division within ENR in 1990. The Center is also affiliated with the University of Illinois, Urbana-Champaign (UIUC). HWRIC's building, the Hazardous Materials Laboratory (HML), is owned and operated by UIUC. HWRIC is charged with a mission to address the state's waste management problems through: research and education; information collection, analysis, and dissemination; and, direct technical assistance to industry, agriculture, and communities. Working with industry to reduce waste at the source, and to recycle those wastes that cannot be reduced, is a priority strategy of the Center.



**FIGURE 1-1: HWRIC DIRECTOR
DAVID L. THOMAS, PH.D.**

The Center's focus on waste reduction was formalized in September 1989 by the state's *Toxic Pollution Prevention Act* (TPPA). This Act (Public Act 86-914), which was amended in 1990 by Senate Bill 2253, expanded the Center's five programs (Research, Information Services, Industrial and Technical Assistance, Data Management, and Laboratory Services) to include a Pollution Prevention Program. HWRIC's current organizational structure is illustrated in Figure 1-2. Table 1-1 lists FY'93 HWRIC staff.

The state-funded headcount for HWRIC during FY'93 was 26, although during 1992 we had a headcount of 30. Total staff at HWRIC, including contract and part-time personnel, is about 45. The state budget for the Center is about \$2 million, with about \$800,000 of this designated for sponsored research projects.

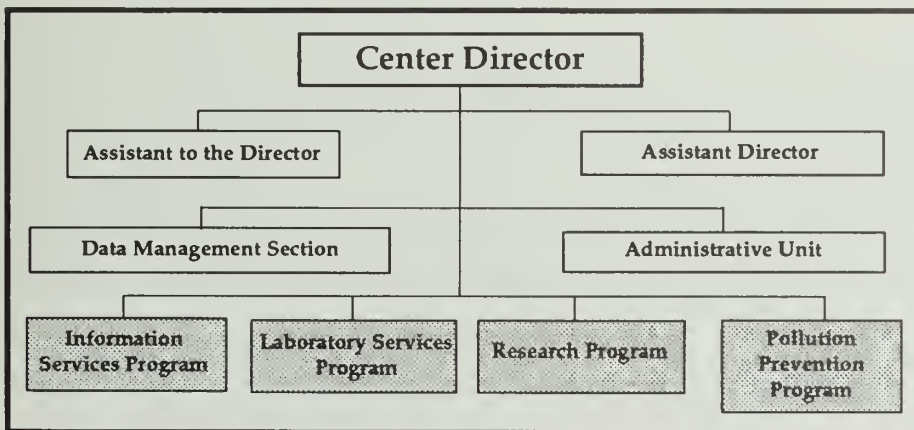


FIGURE 1-2: HWRIC FY'93 ORGANIZATIONAL CHART

The Center answers to the Board of Natural Resources and Conservation (BNRC), which is constituted within ENR. The Board was formed by legislation (PA80-1218) to select and appoint staff of the Scientific Surveys and HWRIC, and to provide programmatic oversight. The Center also has a Program Advisory Panel (PAP), the primary purpose of which is to provide an external source for advice on the Center's overall program. The panel includes representatives from industry, other state agencies, and environmental groups.

This report differs from previous annual reports in some significant ways. Whereas past reports dealt with a summary of program activities, this report is organized by types of activities and outreach provided by the Center. It more accurately describes the integrated nature of all of HWRIC's programs to help meet our mandate of finding solutions to Illinois' hazardous waste problems. However, organizing the report in this way does create some redundancies in summaries of specific program activities between sections. For example, we have discussed some of our activities to help small businesses, but many of these same activities are also provided to medium and large businesses.

This annual report is organized to be more helpful to clients -- chapters are grouped by activities and outreach.

Chapter II of the report presents a brief summary of each of the Center's programs and services offered. Chapter III summarizes the Center's outreach efforts to various groups within Illinois. The focus of much of HWRIC's outreach last year was to promote pollution prevention and to provide information and technical assistance. Chapter IV discusses the various collaborative efforts undertaken by the Center, primarily with others in the state or with federal agencies. The emphasis here is on the collaborative nature of each project and the role the Center played in addressing the particular waste management issue. Chapter V describes the Center's research efforts, both sponsored research and projects undertaken by HWRIC staff. Section VI on internal resource development describes some of the tools developed within the Center to help staff better serve their customers. In Chapter VII, Future Directions and Needs, we explore both old and new areas in which HWRIC could provide assistance in resolving pollution problems and spurring environmentally conscious economic growth.

We hope that you find the new format of this annual report helpful. Despite the additional work on our parts to attempt to adequately express the integrated nature of our work, it became a learning experience for all of us, and a worthwhile exercise. It is obvious to us that the modern complex environmental problems we face require the cooperation and coordination of specialists from many disciplines. We attempt to provide this integrated approach both within our Center, and by teaming with others outside the Center. This report tries to convey the nature and extent of these collaborative services.

TABLE 1-1: HWRIC FULLTIME STAFF BY PROGRAM, FY'93*

***(NOTE THAT FUNDING SOURCES VARY)**

Administration

David Thomas, Director
Gary Miller, Assistant Director/Pollution Prevention Program Manager
John Marlin, Assistant to the Director
Daniel Kraybill, Waste Management Assistance Specialist
Katherine Day, Human Resources and Administrative Services Manager
Christine Murphy-Lucas, Business and Finance Manager
June Wilhite, Laboratory Purchasing Agent
Karen Miller, Human Resources/Office Assistant
Betty Stites, Office Assistant

Data Management

John Garver, Data Management Officer
Martin Bailey, Database Management Specialist
Lisa Damon, Database Management Assistant
Steven Murray, Database Management Assistant

Laboratory Services Program

Marvin Piwoni, Laboratory Services Manager
Teresa Chow, Senior Analytical Chemist
Jack Cochran, Senior Organic/Analytical Chemist
Scott Dalbey, Facilities and Safety Coordinator
Bradley Daniels, Screening Lab Chemist
Gina Eversole, Organic Preparations Chemist
Debbie Gaines, Computer Systems Specialist
Peter Gintautus, Research Associate
David Green, Gas Chromatographer
Amy Hughes, Inorganic Preparations Chemist
Debra Morrow, QA/QC Specialist/Research Liaison
Aaron Weiss, Senior Inorganic/Analytical Chemist

Pollution Prevention Program

Gary Miller, Assistant Director/Pollution Prevention Program Manager
Laurie Case, Environmental Education and Training Specialist
Timothy Lindsey, Technology Engineer
Laura Mendicino, Environmental Engineer
Joe Pickowitz, Pollution Prevention Technical Assistant
Beth Simpson, Pollution Prevention Technical Assistant

Research Program

Jacqueline M. Peden, Research Program Manager
Pamela Tazik, Research Project Officer
Angela Simon, Research Program Assistant

Information Services Program

Sara Tompson, Information Services Program Manager/Librarian
Renee Ketchem, Information Assistant
Jenny Saunders, Office Assistant/Receptionist

Chapter II: Summary of Programs and Services

A. Introduction

This Chapter is meant to provide a brief overview of some of the Center's programs, services and priorities. For more detailed information, the reader is referred to HWRIC's annual reports which have been published regularly since 1985. Copies of many of these are still available through the Center's Clearinghouse. Details of some aspects of each of these programs are also covered throughout this report.

B. Pollution Prevention

In 1986, HWRIC's Pollution Prevention Program was established as a long-term approach to solving Illinois' waste management problems. HWRIC's program relies on direct technical assistance to industry, education programs, as well as research support, to promote waste reduction and improve waste management. The Illinois *Toxic Pollution Prevention Act* (TPPA, Public Act 86-915), passed in 1989, formalized HWRIC's Pollution Prevention (P²) Program and delineated specific responsibilities. These responsibilities include the following:

- Provide information on and publicize the advantages of pollution prevention
- Establish courses, seminars, and workshops
- Produce publications
- Develop and provide curricula and training
- Research pollution prevention methods
- Provide on-site technical assistance to identify opportunities and develop plans
- Sponsor pilot projects to develop and demonstrate innovative technologies
- Establish and operate a clearinghouse
- Use engineering field internships to identify P² opportunities.

An effective pollution prevention program looks at all wastes and releases to all media — air, water and land. HWRIC's program encourages companies to look at the flow of materials through their facilities, to identify where and why wastes are generated, and to identify ways of reducing these wastes. Pollution prevention is a win-win program, wherein the environment can be protected while businesses cut costs and increase efficiency and competitiveness.

A full description of HWRIC's Pollution Prevention Program was recently published — Thomas, David L. and Gary D. Miller. 1992. "Illinois' Program to Promote Industrial Waste Reduction." *Journal of Hazardous Materials* 29: 199-235.

The specific activities of HWRIC's P² program are:

- Provision of industrial technical assistance
- Development and demonstration of clean technologies
- Recognition of exemplary pollution prevention accomplishment through the annual Governor's Pollution Prevention Awards, and
- Education, training and technology transfer.

A very important HWRIC pollution prevention activity over the last couple of years has been to help companies implement and sustain pollution prevention programs. To assist in this regard we have published a manual entitled *Pollution Prevention: A Guide to Program Implementation*, available from HWRIC's Clearinghouse (Report TR-009).

No state appropriations have been provided under the Illinois TPPA to carry out HWRIC's designated responsibilities. The Center's pollution prevention program utilizes approximately \$500,000 of HWRIC's annual state General Revenue Fund (GRF) appropriation. In addition, some federal funds were obtained in FY'93 to supplement this support.

The most visible aspect of HWRIC's Pollution Prevention Program is technical assistance. P² staff provide information and services on solving environmental problems to Illinois citizens, businesses, educational institutions, communities, and governmental units. Source reduction, recycling, and other methods of waste reduction are emphasized. Other services include: guidance on regulatory and permitting matters; recommendations on appropriate waste handling methods; and, referrals to qualified service organizations.

Because HWRIC is a non-regulatory organization, the assistance provided is advisory only; companies and individuals are not required to follow the recommendations and advice given by Center staff. HWRIC does not report site-specific findings to state regulatory agencies.

HWRIC also funds clean technology development and demonstration projects under its Reduction and Recycling Technologies (RRT) Program. The RRT Program promotes pollution prevention in Illinois by providing up to \$100,000 per year for applied research. Awards can be obtained for development or demonstration of waste reduction techniques and technologies, or for testing new applications of existing methods. An RRT award must be equally matched by the contractor with either funding from other sources or in-kind services. Projects generally focus on: modifying of industrial processes in order to eliminate, reduce, or substitute for toxic materials; or, testing the capabilities of equipment for reducing, detoxifying, or recycling wastestreams.

Under the RRT program, Center staff provide technical support to Illinois businesses and industries to develop ideas into workable projects. HWRIC engineers and scientists are available, upon request, to provide "hands on" assistance with project development, initiation, and management. In order to facilitate these efforts, HWRIC has equipped the Hazardous Materials Laboratory's (HML) Pilot Laboratory with pilot-scale ultrafiltration, reverse

osmosis, vacuum evaporation and centrifugation technologies. In addition, HWRIC has constructed a test apparatus for the evaluation of alternative parts cleaners, primarily aqueous-based cleaners.

C. Research

Each year, HWRIC receives an appropriation to support research to:

- Investigate the problems associated with historical and existing waste management practices
- Explore solutions to those problems, and
- Develop ways to prevent those problems from occurring in the future.

The distribution of these funds and the monitoring of how they are used are the responsibility of the Center's Research Program. For FY'93, the money appropriated to fund research was \$662,388. These funds are primarily available to investigators working in Illinois, although researchers from other states have received limited support for projects of significance to Illinois.

Each year, HWRIC Research Program staff and management identify topics of particular interest to the state and solicit preproposals in those areas during December and January. The preproposals that are received are evaluated by Center staff. Then, full proposals are requested from those researchers whose ideas address important waste management problems and/or offer significant scientific contributions towards our knowledge of waste management issues. Full proposals are evaluated both by Center staff and external peer reviewers. Those projects that respond to the most urgent problems and seem most likely to succeed or have an immediate benefit are selected for funding. Projects generally begin October 1.

HWRIC funded 28 projects during FY'93. Nineteen of those projects will continue during FY'94.

HWRIC's second solicitation, for RRT projects (described above), is directed toward industry and focuses on technology development and evaluation. The RRT request for proposals is announced each February, preproposals are reviewed internally, and projects are selected for funding beginning October 1. HWRIC requires a 100% match by the industry participants for the projects selected through this solicitation. Those projects selected generally make most use of the services, equipment, and the expertise of Center staff. Often RRT projects involve in-plant assistance and testing as well as investigations in HWRIC's Pilot Laboratory facility. The outcome of these endeavors are new technologies or new uses for existing technologies with potential widespread industrial application.

The Research and RRT projects selected for funding during FY'93 are discussed in Chapter V. While some projects investigate the extent of existing contamination problems, most are examinations of methods for treating the

problem, or techniques and technologies to prevent future problems. HWRIC Research Program staff work with the investigators during the course of their projects, providing comments on the work as it progresses, serving as sources of information when needed, and often assisting in actual process evaluations. Research staff have worked to supplement the funding allocated to the program by co-funding projects with other agencies and obtaining external funding to pursue additional topics of interest to the Center. These efforts will continue in FY'94, as described in Chapter VII.

The results of Center-funded research, as well as Center-conducted research, are made available in a variety of ways. Publication of articles in peer-reviewed and technical publications is encouraged as are presentations at meetings, seminars, and workshops. Factsheets and brochures are prepared and distributed to technical organizations and companies that might benefit from the information they contain. Most research projects end in peer-reviewed research reports published by HWRIC and made available through our Clearinghouse.

D. Laboratory Services

The Laboratory Services Program (LSP) was developed to provide analytical and logistical support to researchers working with hazardous waste. Program analytical resources are particularly well suited to explore the chemical problems associated with industrial development of waste reduction, recycling and reuse strategies. The HML is a 44,000 square foot facility which houses all activities of the Center. The HML building includes approximately 20,000 square feet of laboratory space. This space is partitioned between the analytical functions of the LSP staff, the Center's Pilot Engineering Laboratory activities, and the research laboratory space. Analytical laboratories include:

- Three wet chemistry labs primarily used for sample preparation
- A screening lab
- A soil/sediment lab, and
- Three instrumentation labs, including:
 - Gas chromatography/mass spectroscopy
 - Liquid/ion chromatography, and
 - Metals analysis.

Research laboratories include a toxicology lab, two waste management research labs (each 720 square feet), and four "high-hazard" labs. A 1,450 square-foot Pilot Laboratory completes the active laboratory work space (see Figure 2-1 on the following page).

FIGURE 2-1: THE HWRIC LABORATORY FLOOR PLAN

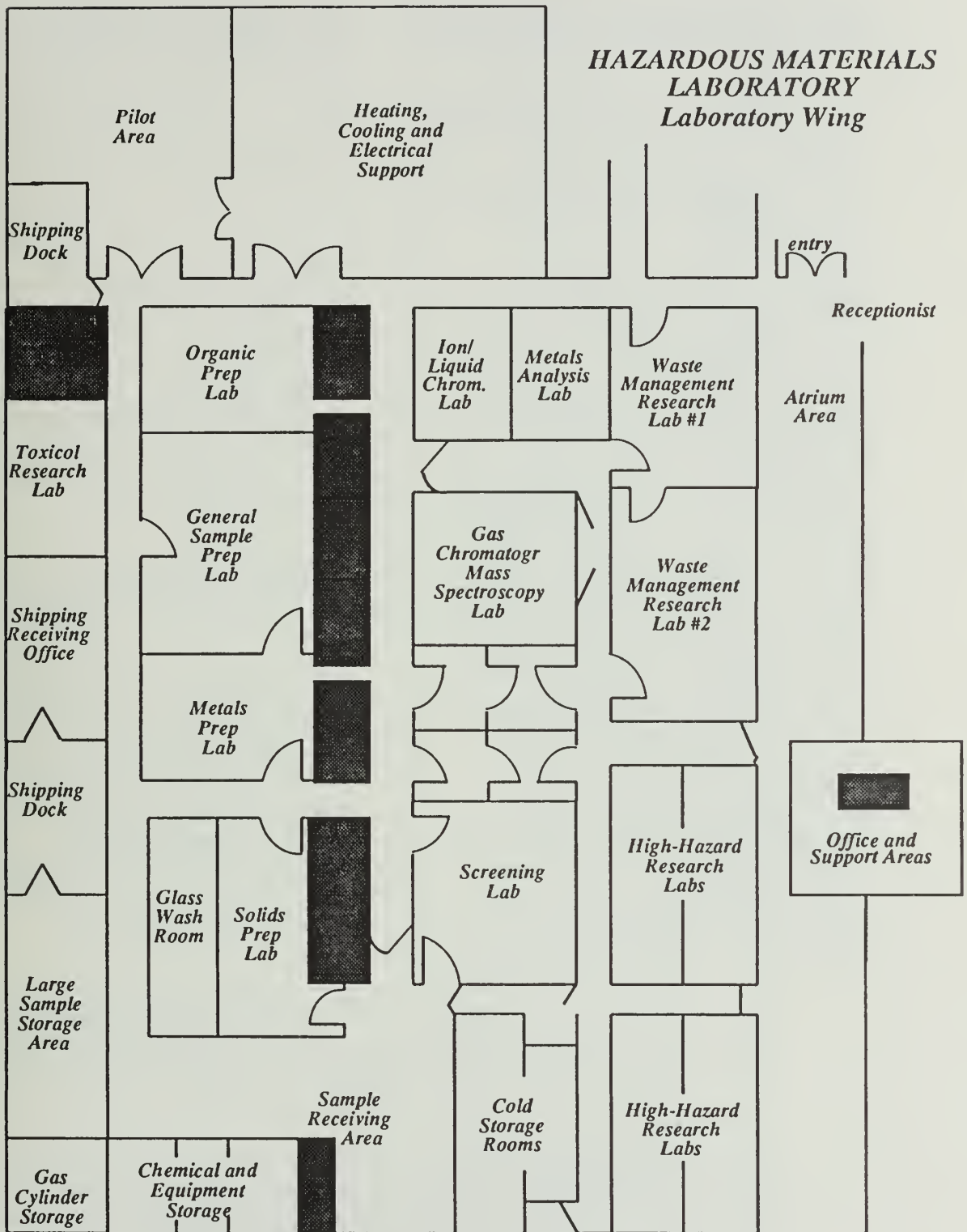


TABLE 2-2: LABORATORY PROJECT SUPPORT MECHANISMS

Project Support Mechanisms	
Support Area	Client Served Support Provided
HWRIC Funded Projects	Projects conducted at the HML or at the facilities of the principal researcher. The LSP provides analysis of samples for primary quantitation and for quality assurance purposes.
In-House Projects	Projects conducted in the pilot lab or by HWRIC staff in the field, often in direct support of industry. The LSP provides analytical methods development and sample analyses, as well as logistical assistance.
External Researchers	Researchers working independently of the Center who do not have access to the analytical capabilities needed to carry out their projects. The LSP provides analytical methods development and sample analyses as requested.
LSP Contracts	LSP staff have obtained several federal government contracts to support research efforts by various agencies. Contracts generally involve agency staff conducting at least part of the research effort within the HML. LSP staff provide analytical and logistical support and methods development. In several cases, the LSP provided literature research using a contract employee. Some of these contracts included provisions for LSP staff-directed research.

The laboratories are fully equipped to provide chemical analyses on a wide variety of analytes of environmental and industrial processing interest. The staff has experience with methods development and analysis of contaminants in a wide variety of matrices. Chemical, toxicological and research capabilities of the laboratories are summarized in Table 2-1 on the next page.

The research labs are accessible to researchers who wish to avail themselves of the special design characteristics of these laboratories. Access is granted to researchers on a case-by-case basis with consideration given to project relevance, safety, compatibility, and other factors. The user is assessed a fee only for the maintenance and management costs borne by the Center.

LSP staff involvement in project support has evolved into several distinct mechanisms since the opening of the facility in 1990. The client base includes researchers from the scientific surveys and from the University of Illinois at Urbana-Champaign (UIUC); researchers from diverse locations who have received funding through HWRIC's Research Program; industrial clients attracted through other HWRIC program outreach efforts; and federal agencies such as the US Army Corps of Engineers.

Some of these clients seek to use the HML's facilities to conduct all or some portion of their research efforts. Others are conducting their research activities in their own laboratories, but enlist the LSP to provide analytical and other types of support. Project support mechanisms for use of the HML are shown in Table 2-2.

HWRIC laboratory staff are involved with the conduct of research projects for many Pilot Laboratory and related industrial support efforts. Such projects are often aimed at evaluating the effectiveness of an evolving pollution prevention or treatment technology on specific wastestreams. The LSP works closely with staff from other programs to provide the sample analyses needed to evaluate project success.

TABLE 2-1: MATCHING INDUSTRIAL NEEDS TO HWRIC LABORATORY CAPABILITIES

Prospective Analytes	HWRIC's Laboratory Capabilities
Generic Pollution Measurements	Total carbon; total organic carbon; chemical oxygen demand; total and suspended solids; total organic halogen; oil & grease; total petroleum hydrocarbons; dissolved oxygen; conductivity; turbidity; pH. Other routine and project specific analyses.
Regulated Organic Compounds	Full analytical capabilities for volatile and semi-volatile organics and pesticides by GC-specific detection (FID; ECD; NPD; ELCD; PID), GC/MS and HPLC.
Specialty Organic Compounds	Water soluble compounds, ie. surfactants, by HPLC; HPLC/MS; capillary electrophoresis; and ion chromatography. Less polar compounds by GC/MS and GC/FTIR. Organometallics by GC/atomic emission detection.
Regulated and Nonregulated Metals	Metals and metalloids by flame atomic absorption spectrometry (AAS); furnace AAS; inductively-coupled plasma/mass spectrometry (ICP/MS); flow injection ICP/MS; mercury amalgamation ICP/MS; hydride generation AAS or ICP/MS.
Inorganic Ions including cyanide, ammonia, and sulfate	Most anions and cations by ion chromatography; flow injection spectrometry; capillary electrophoresis; ion specific electrode; and colorimetric analysis.
Special Services	Full pilot lab support with demonstrated expertise in reverse osmosis; ultrafiltration; and vacuum evaporation; parts cleaning alternatives; TCLP; Microtox toxicity testing; methods development services for unusual analyses. Limited bench testing capabilities.
Various Matrices	The laboratory staff has experience with trace and industrial waste levels of pollutants in matrices including soils, foundry sand; industrial waste streams; industrial sludges; air samples; ground waters; process waters; surface waters; rainwater; industrial glasses; oily wastes; paint waste; plant tissues; and various other materials.

The LSP staff supports several federal agency contracts to provide analytical work for specific research efforts. Involvement in some of these longer term projects not only permits more equal distribution of the workload over the year, but also allows the staff to explore challenging analytical problems. These contract projects also contribute much-needed resources for operation and maintenance of the laboratory equipment.

E. Information Services

Fulfilling HWRIC's legislative mandate to compile, analyze, and disseminate hazardous waste-related information is the principal responsibility of the Information Services Program (ISP). This task was mandated in the legislation that created the Center, the *Hazardous Waste Technology Exchange Service Act* (PA 83-1436, 1984). Recent legislation goes even further in mandating information services.

The *Toxic Pollution Prevention Act* (see Section B above) mandated a variety of pollution prevention activities at HWRIC, including development of a clearinghouse. HWRIC's Clearinghouse has been part of the Center since its inception; TPPA provided further impetus to expand the pollution prevention area of the collection.

HWRIC's main information resources are contained in its Library and Clearinghouse. The HWRIC Library contains close to 8,000 items, including books, government reports, journals, maps, video and audio tapes, and articles. All of the items are cited in an in-house computerized database, so bibliographies of our holdings can be produced on any topic and in any format desired. The library collection does not circulate directly outside the Center, but interlibrary loan requests are honored.

The Clearinghouse includes two collections of information materials. The first is the collection of HWRIC-produced reports including over 100 items. Most of these are final reports on research projects sponsored by the Center. Also included are technical and administrative reports. HWRIC charges a nominal fee for reports to recover some reproduction costs.

The second Clearinghouse collection of over 200 items includes brochures, pamphlets, and other brief publications produced by HWRIC, IEPA, USEPA, and other agencies. These are arranged in 23 topical areas. There are nominal charges for large volume requests.

Program staff use the Clearinghouse collection to fill requests for information from Illinois industry representatives, educators and citizens. The ISP uses both the Clearinghouse and Library collections to provide support to HWRIC staff in their efforts to resolve waste management problems and to promote pollution prevention in Illinois. In addition to managing the Library and Clearinghouse resources, ISP staff share responsibility for conducting public affairs and outreach activities, including presentations, mailings, and report production.

F. Data Management

Conducting hazardous waste research and providing assistance to industry requires current information on the locations, quantities, properties, and components of hazardous materials and waste management facilities. The management and analysis of this information requires the use of computers and computer databases.

The HWRIC Data Management Section (DMS) of the Administration Unit is designed to serve both the research and information missions of the Center as well as the hazardous waste data needs of others in Illinois. This task is accomplished by gathering data from various sources, processing it into an integrated file structure, analyzing it, and making the results available through various reports and by direct access. In addition, as part of the Illinois Geographic Information System (IGIS) within the Department of Energy and Natural Resources (ENR), Data Management staff provide access to many other data resources in the state for geographical mapping analysis.

The two main objectives of the DMS are to develop a hazardous waste database for Illinois (including data acquisition, documentation, integration, and verification) and to apply the database information to environmental issues in Illinois (Table 2-3). Program staff also provide support for the Center's electronic data processing needs. This support includes software and hardware evaluation, programming, administration of the Center's local area network (LAN), and staff training.

The hazardous waste database is used to identify hazardous waste sites at or near properties that are being sold. The mapping capabilities of the database are used to assess relationships between potential sources of toxic releases, known areas of contamination, and areas of requested investigation.

In addition to providing database searches for Responsible Property Transfer requests, Data Management staff also provide the public with information about the sources, procedures, and limitations that exist in the proper interpretation of many environmental databases. The database has been used to develop the "Degree-of-Hazard" categorization scheme that can be used to declassify special wastes not covered under RCRA (the federal Resource Conservation and Recovery Act). Also, information retrieved from the database has been used to define and characterize various hazardous waste activities so better policies can be developed to manage those wastes.

To date, HWRIC has obtained 17 types of hazardous waste-related files from about seven sources and projects. Most of these data exist as a result of legal mandates to state and federal agencies (mostly IEPA and USEPA) that are required to monitor and regulate hazardous waste activities. Data have also been obtained through research conducted or sponsored by the Center.

To aid the public and environmental consultants in understanding the sources of environmental data, HWRIC has prepared a factsheet entitled *Where to Find Illinois Waste Management Data Files* (Report TN92-023) that is available from the Clearinghouse.

TABLE 2-3 HWRIC DATA MANAGEMENT OBJECTIVES

<i>Objectives of HWRIC's Data Management Section</i>	
1) Develop a hazardous waste database for Illinois	<ul style="list-style-type: none"> * Obtain waste management data files from other states * Obtain current information on toxicity and environmental effects of wastes and constituents * Geocode locations of waste sites and activities * Obtain environmental information in relationships between waste sites and affected media (air, land, and water)
2) Use database to address hazardous waste issues	<ul style="list-style-type: none"> * Assess the amounts and types of wastes generated, treated, stored, and disposed of in Illinois * Provide data to state and local agencies, decision-makers, industry, and the public * Project trends of types and amounts of waste expected from level of activity indicators * Identify potential environmental and health risks from predicted exposure to toxic chemicals * Provide detailed information on the chemical properties, disposal methods, safety, and regulatory status of specific wastes * Produce maps of waste activities and related environmental factors using GIS software
3) Provide HWRIC EDP support	<ul style="list-style-type: none"> * Evaluate and advise on selection of hardware and software * Assist in maintaining hardware and providing software user support * Provide specialized programming for accounting, personnel, bibliographic, and other applications

Chapter III: Outreach and Services

A. Introduction

Since HWRIC was established in 1984, a major function of the Center has been to provide waste management and pollution prevention assistance to Illinois businesses, manufacturers, educational institutions, citizens and communities. Important environmental concerns throughout the state include:

- Safe use of chemicals in industry and the home
- Identification of technologies and techniques to reduce and better manage waste
- Analysis of risks posed by chemicals released from nearby industries and waste management facilities, and
- Siting of waste management facilities.

Increasingly, HWRIC has become the source of reliable information about these and similar issues in the state. There are many reasons why companies, educational institutions, communities and individuals call on the Center's expertise. Individual citizens contact HWRIC because they want to know what actions they can take to protect their environment. Companies often need help coping with environmental regulations that are becoming more complicated each year. More than ever, companies are trying to find ways to reduce the amount of waste they generate in order to:

- Decrease their rapidly escalating costs for waste management
- Improve their public image
- Come into regulatory compliance, and
- Gain a competitive edge.

Specific types of questions typically asked of HWRIC staff include:

- What regulations apply to me? Do I need a permit for what I am doing?
- Do any of the new Clean Air Act regulations affect my company?
- What about the storm water requirements of the Clean Water Act?
- What can I do to properly dispose of my wastes?
- Is there a recycling service for my needs?
- Who can give me information on treatment technologies, consulting services or pollution prevention approaches?
- Can you help me apply to have my special waste reclassified as a general solid waste? What are the procedures?

- Is there a hazardous waste concern with a property I am interested in purchasing? If so, what is the nature of the concern?
- What can I do to properly dispose of leftover paints, pesticides and other household hazardous wastes?
- What remediation technologies are most effective for my leaking underground storage tank?
- Can you provide training for our company on pollution prevention and help us identify what steps we should take to reduce waste generation from our production processes?
- What chemical analytical capabilities and pollution prevention testing equipment do you have for evaluating options for my waste?

Assistance provided by HWRIC staff in response to these questions includes:

- Immediate answers to telephone inquiries
- Preparing written responses
- Sending informational materials from the Center's Clearinghouse
- Conducting on-site assessments, and
- Providing speakers for seminars and meetings.

HWRIC places high priority on providing timely and high quality responses to technical assistance requests. In some cases the required information is readily available from HWRIC's Clearinghouse, or other information resources, and a response can be provided right away. In other cases, it is necessary for HWRIC staff to review various publications or databases such as conference proceedings, technical journals, newsletters, statutes and regulations in order to provide the best response.

The extent of on-site assistance provided to a company ranges from a single visit to several visits in order to develop recommendations. The most time-consuming assistance activities, but also those of greatest potential benefit to companies, are collaborative technology development and evaluation studies.

HWRIC's services are described in more detail below. HWRIC generally responds to companies on a first-come, first-served basis. Because the Center has a small staff level, requests often require prioritization based on the potential benefits to the company and state.

Printed materials help HWRIC staff reach more companies with pollution prevention and other waste management information. Accordingly, during FY'93 a guide to implementing a pollution prevention program was pub-

lished, several factsheets were developed, and the results of technology testing studies were publicized. Some of these publications are shown in Figure 3-1 on the following page.

Technology information transfer often provides a useful component to the Center's technical assistance efforts. The Waste Reduction Advisory System (WRAS) is a computerized approach to information transfer on pollution prevention successes. The WRAS has been developed over the past seven years by HWRIC in cooperation with the U.S. Environmental Protection Agency (USEPA) and several states' pollution prevention programs. Other sources of technology information used to provide assistance are reports from research projects sponsored by HWRIC, particularly those undertaken as part of HWRIC's Reduction and Recycling Technologies (RRT) matching fund program (see Chapter V of this report).

A summary of the number of outreach assistance activities undertaken in the past year is given in Table 3-1. Assistance can vary from answering telephone inquiries to a full scale research study on a particular problem. Most Center assistance efforts are outreach to businesses, since businesses need assistance in regulatory compliance, waste management services, and pollution prevention methods. Over the past three years, there has been a notable increase in the amount of pollution prevention assistance requested while, at the same time, the interest in regulatory assistance from HWRIC has remained strong. Provision of printed information is an important component of HWRIC's assistance. During FY'93, about 6,500 publications were sent to over 2,100 organizations and individuals.


TABLE 3-1: SUMMARY OF HWRIC OUTREACH AND ASSISTANCE

<i>Summary of HWRIC Outreach (by client type), FY '93</i>				
<i>Type of outreach activity</i>	<i>Businesses</i>	<i>Citizens & Communities</i>	<i>Educational Institutions</i>	<i>Government Agencies</i>
Inquiries received by Pollution Prevention staff (1547 total inquiries)	532	429	196	390
Of the 1547 inquiries, pollution prevention-specific assistance was given in 322 instances	203	102	2	15
Of the 1547 inquiries, regulatory questions were answered in 243 instances	119	68	33	23
Pollution Prevention and Information Services Program staff distributed 6,499 publications	2688	1186	943	1682

FIGURE 3-1: SOME NEW HWRIC POLLUTION PREVENTION PUBLICATIONS

Pollution Prevention: A Guide to Program Implementation


Illinois
Hazardous Waste Research
and Information Center



A Division of
ENR
Department of
Energy and
Natural Resources

February 1993
TR-009

1993 025
July 1993



ILLINOIS HAZARDOUS WASTE RESEARCH AND INFORMATION CENTER
1000 S. WOOD ST., CHICAGO, ILL. 60605
TEL. (312) 333-8990
FAX (312) 333-8991

POLLUTION PREVENTION

Information and Updates from HWRIC

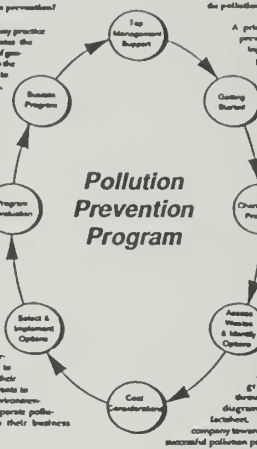
Implementing A Pollution Prevention Program

What is pollution prevention?

Pollution prevention is any practice that reduces or eliminates the amount and/or the toxicity of generated wastes released to the air, land or water prior to management practices, treatment or disposal. Pollution prevention includes the design of products and processes that will lead to less waste being produced. As a total plant philosophy, a pollution prevention program examines and implements methods to reduce hazardous, special and nonhazardous wastes.

Why do pollution prevention?

A principle benefit of a pollution prevention program is the cost savings that can result from such a program. Also, through various pollution prevention methods such as source reduction, in-process recycling, and reducing waste stream toxicity, a pollution prevention program makes the working environment safer for all employees. Additional benefits include: protecting the environment, meeting compliance issues, reducing liability, and promoting better community relations.



Who should implement pollution prevention?


Any business that generates waste, that wants to keep one step ahead of their competitors, and that wants to improve their facilities-environmental policies should incorporate pollution prevention into their business philosophy.

How do you start a pollution prevention program?

A pollution prevention program is a continuous cycle through the eight continuous steps diagrammed and explained in this fact-sheet. Each step will help guide a company toward developing and sustaining a successful pollution prevention program.

For additional information or assistance, please contact HWRIC at (312) 333-8990.
The Illinois Hazardous Waste Research and Information Center is a division of the Department of Energy and Natural Resources.

1993 030
July 1993



ILLINOIS HAZARDOUS WASTE RESEARCH AND INFORMATION CENTER
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FAX (312) 333-8991

POLLUTION PREVENTION

Information and Updates from HWRIC

Waste Reduction in Metal Fabrication

Water-Based Cleaners

Water-based cleaners are beginning to replace alkaline degreasers in automotive industrial surface preparation operations. Many metal fabricators successfully convert to aqueous cleaners for degreasing and coating metal. The water-based cleaners eliminate common problems such as corrosion, lubrication, and skin from conventional metal parts. Special additives such as phosphating agents also make the aqueous cleaners suitable cleaning solutions for aerospace precision air-pneum applications.

Waste Generation

Making the switch from alkaline to aqueous cleaners can reduce VOC emissions, improve worker safety, and eliminate the generation of hazardous organic solvent waste, but the use of aqueous cleaners can create a waste disposal problem of its own. Conventional aqueous cleaning tanks are only capable of efficiently operating for a limited period of time before needing replacement due to the build-up of oil and dirt in the tank. Depending upon the size amount of the spent tank solution, treatment or disposal costs can be significant and compounded by the costs associated with lost production time and replacement of new materials.

Cost Study

HWRIC Pollution Prevention Team visited R. B. White, Inc., a metal fabricator, in finding an environmentally responsible way to use both its water disposal costs for its aqueous cleaners. The Bloomington, Illinois metal fabricator had been paying \$15,000 per year to periodically dump and replace its 3000-gallon aqueous degreasing/phosphating tank in order to maintain product quality, meet wastewater discharge limits, and comply with hazardous waste disposal regulations. HWRIC evaluated a range of aqueous and metal-finishing and phosphate laboratory tests to develop the best waste reduction strategy.

Ultrafiltration

HWRIC implemented an aqueous pollution prevention plan which incorporated a full-scale ultrafiltration system directly into the industrial facility's degreasing/phosphating process. Ultrafiltration is a process-driven membrane filtration technology capable of producing a high quality clean tank water. HWRIC staff visited plant personnel to see ultrafiltration in action and the production life of the tank and eliminate the need for

periodic changing and replacement. In the full-scale study, ultrafiltration was able to continuously reuse all oil and dirt from the tank and reuse filtered solution and new materials back in the original process for reuse. By keeping the bath clean, ultrafiltration also improved productivity and product quality, saved money in raw material and disposal costs, and eliminated thousands of gallons of industrial process waste each year. Ultrafiltration brought about a 99% reduction in waste generation with only a seven month payback period.

Because of its unique capabilities to maintain consistent and produce a clean filter, ultrafiltration is emerging as a promising technology for extending the life of aqueous cleaners, as well as avoid other industrial applications including reducing the volume of water washing machines and dye fabrication. Ultrafiltration does not require a complex of chemicals like other chemical treatment methods. Instead, ultrafiltration produces a water phase suitable for reuse and a concentrated phase that is only a fraction of the original volume.

For further information contact:

Tom Lindsay
Pollution Prevention Technology Engineer
(312) 333-8955

How HWRIC Can Help:

- # Engineering Problems
- # On-site Assessment
- # Regulatory Compliance
- # Training
- # Case Studies
- # Waste Reduction Options
- # Matching Funds for Research
- # Information Services
- # Improved Productivity, Process Efficiency and Cost Accounting

The Illinois Hazardous Waste Research and Information Center is a division of the Department of Energy and Natural Resources.

B. Assistance for Business

As described earlier in Section A, HWRIC provides a broad range of waste management assistance services for all types and sizes of Illinois businesses. Large companies most often request help in establishing pollution prevention programs either at the corporate level or at their largest facilities. An estimated 65% of assistance requests come to HWRIC from small businesses. Most of the Center's business technical assistance is targeted to manufacturing facilities. There are approximately 18,000 manufacturers in Illinois including printers, petroleum refineries, foundries and other primary metal industries, metal fabricators, electroplaters, electronics, and automobile and machinery assembly plants.

HWRIC provided technical assistance to about 550 small companies in FY'93.

Other types of businesses that request assistance include: transportation companies such as railroads; utilities; automotive dealers and service stations; banks and insurance companies; laundries and dry cleaners; hospitals; agricultural chemical distributors; and water treatment plants.

HWRIC staff often spend time working with a company's staff reviewing their products and processes, and determining where and why wastes are generated. The waste management assistance services HWRIC staff provide are very similar to our pollution prevention assistance services. The types of waste management assistance given by HWRIC staff include:

- Responding to regulatory questions
- Conducting on-site regulatory assessments
- Explaining new and existing regulations
- Providing information from published literature on treatment technologies and waste management methods, and
- Providing referrals to service companies such as waste haulers and environmental consultants.

Small and medium-sized companies often request help in identifying pollution prevention options for their situations and getting assistance implementing those options. This assistance includes:

- Facilitating meetings with company staff
- Providing training workshops
- Identifying pertinent case studies of what other companies have done to reduce waste
- Finding equipment vendors
- Cooperatively conducting studies to evaluate technical options, and
- Participating in conferences and workshops (over 70 in FY'93, see Appendix A for all presentations).

An hierarchy of waste management options (Figure 3-2) is used by HWRIC staff to help companies identify preferred approaches from both economic and environmental perspectives. Emphasis is placed on motivating companies to adopt pollution prevention options as the preferred choice, followed by recycling whenever feasible.

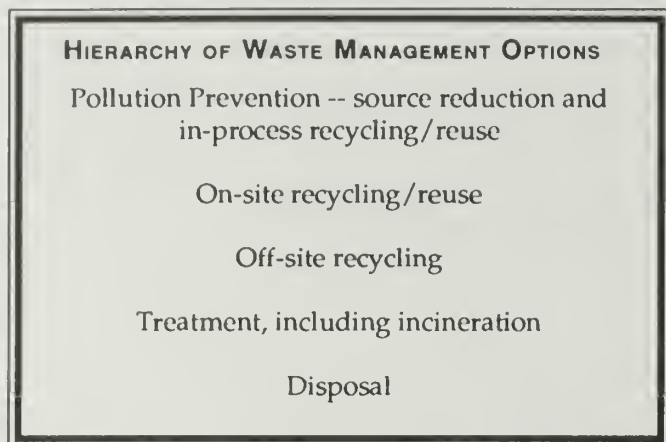


FIGURE 3-2: WASTE MANAGEMENT OPTIONS

1. Regulatory Assistance

In FY'93, 119 companies asked HWRIC for assistance with regulatory matters. The assistance provided by HWRIC staff included:

- Explaining various regulations
- Helping determine which regulations apply to a company
- Recommending appropriate waste handling methods
- Conducting initial environmental audits, and
- Making referrals to qualified service organizations such as recycling and reclamation companies.

Companies are not required to follow the recommendations and advice given by Center staff. Because HWRIC is a non-regulatory organization, the assistance provided is advisory only. HWRIC does not report site-specific findings to regulatory agencies unless a situation clearly and seriously endangers human health or the environment.

a. Examples of Regulatory Assistance

i. Assistance to a Metal Manufacturing Firm

HWRIC personnel visited a metal machine and welding firm to assess potential problems with environmental compliance and possible pollution prevention (P²) activities. The visit revealed minor potential compliance problems, which, once identified, were easily corrected by the company. The firm was very enthusiastic about conducting P² activities. Since this initial visit, the company has begun a pollution prevention program and representatives have worked with HWRIC personnel to reduce the amount and toxicity of the wastes that they generate.

ii. Assistance to a Cabinet Manufacturer

An Illinois manufacturer of wooden cabinets was approached by several consulting firms that were offering analysis services to facilitate applying for a storm water runoff permit. The firms claimed such a permit was required by USEPA. The owners of the cabinet company were unsure of whether or not they were really required to obtain such a permit, and asked HWRIC person-

nel for assistance. One of HWRIC's engineers examined the pertinent regulations, inspected the manufacturing firm, and concluded that no permit was required, which was verified by IEPA. HWRIC's assistance saved the company from unnecessary paperwork, regulatory burdens and consultants fees.

b. Special Waste De-listing Assistance

In 1990, the Illinois Pollution Control Board adopted a regulation requiring a degree-of-hazard evaluation of non-hazardous special wastes as part of a request to have these wastes "de-listed," that is, removed from the list of regulated chemicals.

Non-hazardous special waste in Illinois includes all industrial process and pollution control wastes. Special wastes are regulated much like hazardous wastes in Illinois — such wastes must be reported on a manifest and must be managed in facilities permitted to accept special wastes. Some of these wastes pose a low level of risk to human health and the environment and therefore do not need to be regulated as stringently as other wastes. Getting a waste deregulated can save a company on disposal costs, and can often allow them to recycle the waste. De-listing a waste can also help conserve costly special waste landfill space.

In cooperation with the Institute for Environmental Studies (IES) at UIUC, HWRIC developed and now sells a Degree-of-Hazard computer program that can be used to determine a waste's potential risks. Consultants and individual companies are increasingly making use the software product. HWRIC staff have conducted degree-of-hazard evaluations for a number of wastestreams. In one case, a representative of an automotive division of a major corporation reported that they were able to get two wastestreams de-listed which will ultimately result in savings of up to 10 times over the previous cost of disposal.

The Degree-of-Hazard Computer Program is available from the HWRIC Clearinghouse on a 3.5" or 5.25" diskette for \$50.00, prepaid.

2. Pollution Prevention Assessments

A key service provided since the inception of the Center has been on-site pollution prevention assessments at Illinois companies. These assessments involve an evaluation of the company's management structure to determine what approach(es) to recommend for a company to implement a pollution prevention program. Additional recommendations are often made based on HWRIC's detailed evaluation of a facility's production processes which documents sources and types of wastes generated. HWRIC staff then provide the company assistance in identifying, implementing and continuing pollution prevention options. During FY'93, pollution prevention assistance was given to companies in at least 205 instances.

In many cases, informational materials are sufficient to get a company started on a particular pollution prevention project or program. In other cases, a series of meetings is required. Companies have found that developing a P² program involves changing their culture or way of doing business, which takes time.

HWRIC's on-site pollution prevention assessments include examining a company's processes and operating procedures, identifying types and sources of wastes, and, determining why these wastes are generated. HWRIC staff also discuss management strategies and programs with company representatives to determine the nature and extent of their present P² activities. Often HWRIC can help companies can build P² practices into already existing programs, such as health and safety, total quality management (TQM), industrial modernization, and ISO 9000 quality assurance certification.

One outcome of site visits and assessments is that HWRIC personnel can establish long term relationships with staff from Illinois companies. Often these companies continue requesting assistance from HWRIC staff year after year. In turn, HWRIC's scientists and engineers gain familiarity with what it takes for successful companies to implement pollution prevention programs and projects so that this experience can be shared with other companies.

SOME FEEDBACK FROM HWRIC CUSTOMERS

"Thanks again for taking the time to visit our plant and providing the many suggestions on pollution prevention. Our staff and first line supervisors were very impressed with [your] presentation and will incorporate pollution prevention into our Source Reduction Program." -- *Jerry Midelestadt, Navistar International Transportation Corp.*

"I would like to thank the Hazardous Waste Research and Information Center for its support of the ...training session for international visitors. [The] presentation reached environmental decisionmakers from five nations and two continents." -- *Jon Grand, U.S. Environmental Protection Agency.*

"...with your support, we were able to receive what we consider to be a valuable recognition award." -- *David Hunt, Eagle Wings Industries, Inc.*

"Your institution is fantastic! I want to know the hows and whys of environmental regs. Please send me the following publications..." -- *Bruce Davis, Jr.*

Because HWRIC can provide technical help without focusing on regulatory issues, companies can feel confident that no regulatory action will be taken against them as a result of a site visit. This allows HWRIC staff to work more closely with company representatives than they could if the company staff feared regulatory consequences as a negative outcome of the assistance visit.

FIGURE 3-3: HWRIC CLIENT COMMENTS

3. Small Business Assistance

Since HWRIC was established in 1985, the Center's services have been in high demand by small and medium-sized businesses. Many companies need assistance understanding complex environmental regulations and determining which provisions apply to their situations. They also often need help coming into regulatory compliance. In some cases this simply involves filling out the proper permit applications. In other cases it can involve complex legal

and technical issues. If HWRIC staff cannot readily provide the help that is needed, we will refer companies to other agencies, consultants and service companies that have the specific capabilities the companies' require.

An increasing number of small companies are requesting assistance in evaluating specific pollution prevention technologies. HWRIC has matching funds available for this purpose. Often these evaluations are initially undertaken at the Center's Hazardous Materials Laboratory, but, as much as possible, technology evaluations are also undertaken at the industrial facilities. Such on-site evaluations allow for longer-term testing under actual operating conditions and for the training of company staff.

HWRIC technology evaluation projects with small companies are highlighted below. The first project is a cooperative effort with an industrial trade association. The remaining examples are descriptions of assistance projects with specific companies.

The Pilot Laboratory facility and analytical capabilities, as described in Chapter II of this report, are particularly useful for technology evaluation projects.

a. Valley Industrial Association Project

HWRIC is participating in an innovative partnership with the Valley Industrial Association (VIA), a trade organization comprised of businesses in the Fox River Valley west of Chicago, to promote pollution prevention and business competitiveness. VIA has received a Technology Challenge Grant from the Illinois Department of Commerce and Community Affairs (DCCA). With this grant, they have established a program through which member companies with less than 260 employees can obtain matching funds for projects relating to business improvements and pollution prevention.

As stated in their program literature, VIA's program is designed to:

"...strengthen technology and modernization activities of small and medium-sized companies in the Fox River Valley by providing financial assistance to:

- 1) improve/implement environmental pollution prevention measures, and
- 2) provide manufacturing technical assistance to improve quality and productivity in order to create more product, generate less waste, and improve competitiveness."

Participants in the program have the opportunity to obtain assistance from four entities:

- An environmental attorney
- An environmental engineering consulting firm
- Waubensee community college staff with expertise in ISO 9000 certification and total quality management programs, and
- HWRIC.

HWRIC worked with five VIA companies in the first phase to identify appropriate projects and to assist with proposal preparation for four of these companies.

The program consists of two phases. During the first phase, eligible member companies worked with one or more of the four entities to assess each company's needs and to identify potential projects which would help reduce waste and improve productivity and competitiveness. Phase 2 involved submission of proposals to VIA for matching funding for each company's projects. Funding was awarded on a competitive basis.

Beyond the first two phases of the project, HWRIC will be working with three companies to evaluate pollution prevention technologies and with one other company to conduct a facility audit toward improving productivity and reducing waste. Three of these four companies — Oakgrigsby, ECO Finish, and River Valley Coatings — were awarded funding from VIA.

HWRIC will be evaluating aqueous cleaning processes that involve recycling and/or reuse of the cleaning solutions and rinse waters for Oakgrigsby and ECO Finish. We will also be assisting with a facility audit for River Valley Coatings. Additionally, HWRIC staff will be investigating machine coolant recycling/reduction processes for Teledyne Pines, the company that did not receive funding.

We hope that participation in this program will increase industries' awareness of the kinds of pollution prevention services available from the State of Illinois. The Center would also like to use this project as a model for establishing similar working relationships with other industrial trade organizations.

b. Park Corporation

Park Corporation manufactures food and detergent products according to customers' specific recipes. HWRIC staff visited Park's facility to discuss pollution prevention activities being undertaken at the plant and to conduct a preliminary assessment of their operations.

HWRIC staff gave Park personnel a report containing specific recommendations for developing a P² program and for reducing waste. Recommendations included:

- Eliminating unnecessary packaging materials
- Utilizing reusable containers and pallets, and
- Repairing salvageable off-specification packaging cartons on-line.

c. Waldorf

Waldorf, a printer located in the Southeast Chicago area, produces packaging for food and personal care products. HWRIC staff visited the Waldorf facility and conducted a preliminary assessment of their operations. The resulting report contained specific recommendations for waste reduction opportunities in their operations as well as program development guidelines.

These guidelines encouraged the company to establish a pollution prevention team, implement a waste tracking system, identify the true cost of waste, and transfer successful methods to others.

d. Work Area Protection

HWRIC engineering staff assisted a manufacturer of plastic safety cones in cleaning up a water-based wastestream. The water was contaminated with phthalates (a plasticizer) and other potentially harmful organic chemicals. HWRIC's chemists and engineers tested several filter media in the Center's Pilot Laboratory for the ability to remove the contaminants. Based on the test results, an effective filter medium was selected and a filter system implemented at the facility. The system resulted in a waste reduction of approximately 5,000 gallons per year.

e. Pre-Finished Metals

HWRIC technical assistance engineers worked with a Chicago-based coil coating company to develop a pollution prevention team. They also provided company personnel with models for and information on alternatives for recycling solvent wastes from their finishing baths.

f. Nichols Homeshield

At the request of this central Illinois residential siding manufacturer, Center staff helped evaluate alternatives for recycling aqueous cleaning solutions and reducing oily waste water discharges. Next year, HWRIC engineers will help Nichols Homeshield test an ultrafiltration system for recycling the cleaners at their facility. This company's releases of toxic organic chemicals to the air are being reduced as a result.

g. Eagle Wings

This Rantoul facility manufactures automotive parts, primarily for Diamond Star Motors in Bloomington. Manufacturing processes include stamping, welding, assembly and painting. HWRIC staff helped this company form a pollution prevention team consisting of employees from their various departments. The team will be responsible for identifying and implementing pollution prevention activities for the entire plant. HWRIC staff attended the first several meetings of their team to help initiate the company's P² program.

h. Foundries

With funding from the USEPA, and in cooperation with the American Foundrymen's Society and the Illinois Cast Metals Association, HWRIC conducted on-site pollution prevention assessments at three foundries in Illinois. The goal of this project was to assess current P² practices by typical foundries, and to document current P² activities in the industry.

Next year case studies like these presented here will be compiled into a publication intended to serve as a model for other companies looking to prevent pollution. This document will be available from our Clearinghouse.

During these assessments, effective pollution prevention practices were identified at some companies. For others, there appeared to be reasonable steps the companies could take to modernize production and reduce waste generation. These recommendations will be passed on to the companies in a report.

To begin the foundries project, HWRIC staff drafted a six-step Pollution Prevention Assistance Protocol:

- (1) Contact the company to obtain their participation in the project
- (2) Conduct an initial site visit
- (3) Prepare a report of the first visit
- (4) Conduct subsequent assessment visits
- (5) Prepare report of assessment, and
- (6) Follow-up.

Pollution prevention assessments were then conducted at the three foundries. First, a detailed two-day assessment of the entire facility and processes was conducted at Vermillion Iron Works in Hoopston. Following that, a one-day assessment and presentation on pollution prevention program implementation was made to the company president, supervisors and a union representative at Excelsior Foundry in Belleville. At the third company, Vermont Foundry Company in the Village of Vermont, a one-day assessment was conducted. During these assessments, effective pollution prevention practices were identified and there appeared to be steps some of the companies could take to modernize processes and reduce waste generation.

4. Assistance to Large Companies

An initial request for assistance from a large company is usually for help starting, or further developing, their pollution prevention program. Often this request comes from the corporate level. In some cases an individual facility within a larger corporation requests this type of assistance prior to development of a corporate-wide program.

a. *Abbott Laboratories*

Abbott is a major manufacturer of pharmaceuticals and other health care products. For several years, HWRIC has been working with Abbott to develop a corporate-wide pollution prevention program. HWRIC is now working with Abbott to adapt this program to the plant level and to identify further opportunities for pollution prevention.

During the past year, HWRIC staff members made a presentation on pollution prevention to Abbott staff as part of an internal training seminar. Abbott personnel have visited the Center and HWRIC staff have met with Abbott's corporate environmental department to discuss specifics for a pollution prevention guidance manual.

The manual focuses on mid-sized research laboratories, such as those found at Abbott and at educational institutions. The manual will include information on training for scientists on the concept of pollution prevention, as well as on waste-reducing technologies such as micro-scale laboratory equipment.

b. Illinois Power Company

HWRIC has developed an on-going relationship with Illinois Power (IP), a major utility provider in Central and Southern Illinois. Center staff have provided assistance with pollution prevention program development and recycling opportunities for various resources. HWRIC began working with IP's recycling team members from the Urbana maintenance facility to identify the types and quantities of wastes generated at the facility. An initial assessment was conducted with the team members to identify waste reduction opportunities and to familiarize their staff with the assessment procedure. This allowed IP staff to develop skills to conduct further assessments at other company facilities.

HWRIC staff prepared a report for the IP facility manager which presented the pollution prevention options identified by the P² team and HWRIC. Illinois Power is implementing some of the P² activities recommended in the report at their Urbana maintenance facility and other facilities throughout the state.

c. Motorola

The Center's pollution prevention staff have been working with staff at the Motorola facility in Schaumburg to establish a pollution prevention program. Center staff have regularly provided Motorola employees with case study information relating to their various processes.

Since the new USEPA administration identified pollution prevention as a top priority, Motorola has increased their interest in formalizing a corporate-wide P² program. HWRIC staff made a presentation to Motorola's Environmental Council meeting on developing a comprehensive pollution prevention program. In FY'94, HWRIC will work with both the Corporate Environmental Department and the Communication Sector to further pollution prevention efforts and assist them in implementation of a program at Motorola.

d. Navistar

HWRIC began working with Navistar when the company won a Governor's Pollution Prevention Award. Center staff visited their Melrose Park facility for an awards re-presentation for all shift personnel. HWRIC representatives made a presentation on P² program development to all line supervisors at their daily production meeting. HWRIC staff then conducted a facility assessment at Navistar, and made recommendations for specific waste reduction opportunities and program development.

HWRIC staff are now working with several Abbott staff members to develop a laboratory pollution prevention manual for their product development researchers.

Navistar had already implemented several activities to reduce waste at their facility which resulted in an overall cost savings of \$250,000 in 1992.

Navistar will be using the Center's pollution prevention guidance manual company-wide; they plan to modify the manual to be Navistar-specific and then distribute it to other facilities.

e. General Electric (GE) Motors

This major manufacturer of electric motors requested assistance in reducing or eliminating an oily wastewater problem. Currently, GE Motors has a 4,000 gallon-per-month wastestream from metal cutting and cleaning operations. HWRIC engineers conducted bench scale oil/water separation and ultrafiltration tests to determine if these technologies could effectively treat this wastestream. Results of the testing were very encouraging, and GE Motors plans to rent full-scale systems to perform further testing at their main facility.

f. Burlington Northern Railroad

At the request of this major Illinois railroad, HWRIC engineers worked with company personnel at their Galesburg maintenance facility to:

- Develop a facility pollution prevention policy statement
- Set up a pollution prevention team
- Quantify and assign costs to various wastestreams, and
- Examine technical alternatives for reducing wastes.

Based on the progress of this project, a corporate pollution prevention program is being established. Pilot scale ultrafiltration testing was performed in HWRIC's Pilot Laboratory to evaluate the use of ultrafiltration for recycling a caustic cleaner used at the Galesburg facility to clean locomotives. The results of this testing were also very encouraging.

5. Technology Development and Demonstration Projects

In FY'93, for the sixth year, HWRIC invited Illinois businesses to apply for matching funds under the Center's Reduction and Recycling Technologies (RRT) program. RRT grants are to promote the development, testing, and implementation of pollution prevention technologies. The results of the testing supported by RRT funds are published in HWRIC reports so that other companies with similar processes can benefit. About \$66,000 of research funds were allocated to the RRT program in FY'93. RRT funding must be equally matched by the recipient.

In the past two years, HWRIC has used the equipment in the Pilot Laboratory and the analytical capabilities of the Laboratory Services Program to undertake these cooperative industry/government projects. Usually a graduate student in engineering from the University of Illinois is employed to assist with these projects. The three major new RRT projects undertaken in FY'93 are described below.

a. Die Cast Oil Waste Reduction

Outboard Marine Corporation (OMC) manufacturers component parts for outboard motors and stern driven engines at their Waukegan facility. Approximately 4 million pounds of die cast and oily waste were generated annually at this facility. These materials comprised approximately 47% of the facility's total wastestream and were made up of die lubricants, machine sump oil, hydraulic components and water soluble coolants.

HWRIC engineers worked directly with OMC personnel to evaluate three technologies for their capacity to reduce this waste volume:

- 1) Ultrafiltration
- 2) Vacuum evaporation, and
- 3) Atmospheric evaporation.

Results of the testing indicated that all three technologies could reduce this waste volume by over 90%. Additionally, the water produced from these technologies can be reused in making fresh die lubricant.

An economic assessment of the three technologies indicated that the ultrafiltration system would payback in about 1.2 years, while the vacuum evaporation and the atmospheric evaporation systems would each require about 1.5 years to payback. The ultrafiltration system was ultimately selected by OMC as most economical for permanent use in the facility.

b. Petroleum Tank Sludge Removal and Oil Recovery

In this project, staff of U.S. Emulsion Technologies, Inc. (USET), West Chicago, worked directly with HWRIC personnel to develop a process using surface chemistry and emulsion formation to treat oily sludges. USET had developed a new emulsifier that appeared to be effective for fluidizing oily sludges. These sludges are the solidified materials which accumulate in the bottoms of tanks used at oil fields, pipelines and refineries.

For this study, approximately 330 gallons of sludge were removed from a pipeline storage tank in southern Illinois and brought to HWRIC's pilot lab facility for process development testing (see Figure 3-4).



FIGURE 3-4: HWRIC ENGINEERS WORKING WITH PETROLEUM SLUDGE IN THE PILOT LAB

The treatment system developed in this project is accomplished in three steps:

- 1) Emulsification of the tar-like sludge by mixing in water, diesel fuel and emulsifiers to lower the sludge's viscosity and make it pumpable
- 2) Centrifugation of the emulsified material through a solid/liquid centrifuge to remove dirt, scale and other contaminants, and
- 3) Centrifugation of the oil/water emulsion through a liquid/liquid centrifuge to separate the oil from the water.

The composition of oily sludges varies considerably from site to site.

The sludge used in this project was comprised of about 69% oil, 22% water and 9% solids. The oil generated from this process is approximately 98% pure and can be re-introduced into the refining process. The water can be reused in other processes or ultrafiltered and discharged to the sewer. The solids are the only remaining waste material and they comprise only about 9% of the initial waste volume. Thus, the waste volume is reduced by about 90%, and crude oil that was previously discarded is recovered. HWRIC engineers are working with USET representatives to secure funding to scale up this technology to facilitate testing at an actual production site.

c. Lubricating Oily Water Reduction

A.O. Smith Corporation manufactures automotive structural components at their Granite City facility. Presses are utilized to stamp and shape the various parts produced. In order to reduce press wear, petroleum-based lubricants are applied to the parts prior to stamping. During the cleaning operations which follow, the lubricants are emulsified into the wash and rinse waters and, prior to this project, were ultimately discharged to the sanitary sewer.

HWRIC engineers worked with A.O. Smith personnel to test an ultrafiltration system to remove the oil emulsion from the wash water so that the wash water could be recycled. Based on the results of this testing, A.O. Smith designed and fabricated an ultrafiltration system for use in their facility.

d. *Electroplating Waste Metal Recovery*

As part of the USEPA-funded Waste Reduction Innovative Technology Exchange (WRITE) Program, HWRIC conducted laboratory testing of nickel-containing rinse waters from Graham Plating of Chicago. The goal of the project was to evaluate several treatment technologies for these wastewaters and determine which technology is most effective for recovery of the nickel. Ultimately the plan is to recycle the nickel into the plating operation. Results of the testing indicate that nickel can be removed effectively and economically using a combination of reverse osmosis and vacuum (or low temperature) evaporation. Results are discussed in the project report cited at right.

e. *Amine Brine Waste Water Reduction*

In this project, a chemical manufacturer of amines undertook a cooperative study with HWRIC to develop ways to reduce the brine wastes produced in their process. Several modifications were suggested to the company's operating procedures and process equipment. These changes resulted in increased product yields and less waste. For the remaining wastes, the Center's engineers and chemists undertook a series of tests to identify the most effective treatment technologies. Technologies tested included pH adjustment, electrohydrolysis, evaporation, and crystallization.

6. **Training and workshops**

Training seminars and workshop presentations are paramount to reaching many companies with information about the benefits of pollution prevention and the services provided by HWRIC. The various presentations given by HWRIC staff in FY'93 are listed in Appendix A. Several of the main efforts are highlighted below.

a. *"Alternatives to Organic Solvents" -- Statewide Teleconference*

HWRIC, IEPA, DCCA and the Illinois Manufacturers Association (IMA) cooperatively sponsored a state-wide pollution prevention teleconference on Feb. 11, 1993 at seven sites throughout the state. The topic, water-based alternatives to solvent cleaning, was of interest to many Illinois companies looking for ways to reduce organic solvent emissions.

Over 70 people attended the teleconference and watched experts in the field present case studies of companies that successfully implemented a change from solvent to water-based cleaners. Participants received a 370-page manual and information on how to obtain help from HWRIC, IEPA, and DCCA. HWRIC has a copy of the video of this teleconference and the manual available for use on-site in our library.

Lindsey, T.C. 1993. "Recycling Nickel Electroplating Rinse Waters by Low Temperature Evaporation and Reverse Osmosis." Hazardous Waste Research and Information Center. 60 pp. (Final WRITE Project Report Submitted to USEPA, June, 1993; will become HWRIC report TR-013).

b. *Illinois Manufacturers Association Workshop*

In the fall of 1992, HWRIC staff helped conduct a two-day conference entitled "*Practical Pollution Prevention Programs for Illinois Manufacturers.*" The conference was sponsored by the IMA with funding from the Department of Energy and Natural Resources (ENR). HWRIC staff made presentations on:

- General pollution prevention concepts
- Proposed and existing pollution prevention legislation at the state and federal levels
- Pollution prevention planning strategies, and
- HWRIC services and resources.

c. *Paint Waste Education*

A series of factsheets is being prepared to describe pollution prevention in paint production, application, and removal.

With funding from the state of Illinois's Environmental Protection Trust Fund, HWRIC staff began developing a waste paint education program for industry, homeowners and schools. Under this project, educational materials are being developed to inform paint manufacturers and paint users of available pollution prevention techniques and to promote the adoption of these practices.

d. *Electroplating Seminar*

In November 1992, the Chicago Metal Finishers Institute, the Metropolitan Water Reclamation District of Greater Chicago and HWRIC co-sponsored a pollution prevention workshop for electroplaters. Sessions were presented on trends in pollution prevention, steps to establish pollution prevention programs, alternative electroplating technologies, example applications of those technologies, and pitfalls or limitations. Representatives from approximately 50 companies attended.

e. *Pollution Prevention in Metal Fabrication Seminar*

A conference for metal fabricators was hosted by HWRIC at the HML on April 6, 1993. Over 20 company representatives attended. This conference was sponsored by IRMCO, an Evanston manufacturer of synthetic metal stamping lubricants. Information was provided regarding the regulatory implications of pollution prevention for these companies as well as on successful pollution prevention methodologies. As a result of this conference, several participants are working with HWRIC's engineers in the Pilot Laboratory to evaluate alternative lubricants.

C. Governor's Awards Program

1. Sixth Annual Governor's Awards Presentation

On December 7, 1992, HWRIC hosted the Sixth Annual Governor's Pollution Prevention Awards luncheon ceremony at the Fairmont Hotel in Chicago. Lieutenant Governor Bob Kustra recognized 24 companies and organizations for their exemplary efforts to reduce waste.

At the awards ceremony, Lieutenant Governor Kustra said: "These companies and organizations have made an investment in Illinois' future that will pay dividends, both in terms of the environment and the economy....The Governor and I are pleased to honor these representatives today for their valuable efforts in preventing pollution."



FIGURE 3-5: LT. GOV. KUSTRA, LEFT, PRESENTING THE AWARD TO RICHARD ZIELINSKI AND DAN WESTRUP OF THE CHEMICAL INDUSTRY COUNCIL OF ILLINOIS

For the Governor's Pollution Prevention Awards, eight awards and sixteen certificates of recognition were presented in these categories:

- Community groups
- Trade organizations
- Vendors, and
- Industrial facilities -- small, medium, and large.

Table 3-2 lists the award winners, and Table 3-3 the certificate winners (see the following page for both tables). Descriptions of the award-winning programs are in Appendix B of this report. Approximately 140 industry, community, and government representatives attended the ceremony with all award and certificate winners present to accept their honors.

TABLE 3-2: 1992 AWARD WINNERS

<i>Sixth Annual Governor's Pollution Prevention Award Winners</i>	
Category	Organization
Trade Organization	Chemical Industry Council of Illinois - Rosemont, IL
Vendor	Chicagoland Processing Corporation - Mount Prospect, IL
Small Facility (1-150 employees)	Justrite Manufacturing - Mattoon, IL Hevi-Duty Electric - Mount Vernon, IL
Medium Facility (151-500 employees)	Nichols-Homeshield, Inc. - Chatsworth, IL The Interlakes Companies, Inc. - Pontiac, IL
Large Facility (>500 employees)	Navistar International Transportation - Melrose Park, IL Chrysler Corporation - Belvidere, IL

TABLE 3-3: 1992 CERTIFICATE WINNERS

<i>Sixth Annual Governor's Pollution Prevention Certificates</i>	
Category	Organization
Community Organization	Piatt County Farm Bureau - Monticello, IL Village of Rantoul - Rantoul, IL
Trade Organization	American Foundrymen's Society - Des Plaines, IL
Vendor	First Brands Corporation - Alsip, IL Toppert Sales and Leasing, Ltd - Hillsdale, IL
Small Facility (1-150 employees)	DAP, Inc. - Rosemont, IL Henry Pratt Company - Aurora, IL Fluid Power Systems - Wheeling, IL
Medium Facility (151-500 employees)	National Castings, Inc. - Melrose Park, IL The Marvel Group - Chicago, IL Eagle Wings Industries, Inc. - Rantoul, IL North American Lighting - Flora, IL
Large Facility (> 500 employees)	CCL Custom Manufacturing, Inc. - Danville, IL Imperial Broadware Corporation - Shelbyville, IL Eaton Corporation - Lincoln, IL Motorola, Inc. - Schaumburg, IL

2. Award Re-presentations

Following the award ceremony, five companies requested re-presentations of their awards or certificates at their facilities. Each ceremony gave company leaders the opportunity to share the honor with all of their employees. It is often the employees who are responsible for the success of pollution prevention activities. The re-presentations are a way to recognize many of these employees efforts. Awards were re-presented in each instance by HWRIC's Director, and each ceremony was usually followed by a tour of the facility.

a. *Eagle Wings Industries - Rantoul*

At the request of Eagle Wings, a re-presentation was conducted at their facility. Eagle Wings, an automobile parts manufacturer, was selected for a certificate of recognition for their efforts to address pollution prevention while improving production. By converting to a paint with a lower volatile organic compound (VOC, potentially hazardous) content and reducing the size of the sheet metal blanks in their stamping operation, Eagle Wings was able to greatly reduce their waste generation and realize a significant cost savings.

b. *Navistar International Transportation Corp. - Melrose Park*

HWRIC re-presented Navistar's award at a ceremony conducted on their plant floor. Both management level employees and line workers were in attendance at the event shown in the picture below.

Navistar's Melrose Park facility manufactures light and medium duty diesel truck engines. Navistar was recognized for their Source Reduction Committee made up of members from every business unit of the plant.

The committee targeted several wastestreams, based on volume, toxicity, and cost, and implemented several activities to reduce waste. These resulted in overall cost savings of approximately \$250,000 in 1992.



FIGURE 3-6: HWRIC DIRECTOR DAVID THOMAS, RIGHT, RE-PRESENTING NAVISTAR'S AWARD TO TERRY CAMPBELL, PLANT MANAGER

HWRIC staff returned to the Melrose Park facility for a more in-depth tour of the facility, during which they provided suggestions for further waste reduction. HWRIC staff made a presentation on P² program development to Navistar's operating supervisors.

Re-presentations of pollution prevention awards are given at the request of award winners. Many industry awardees have requested re-presentations at their facility sites.

As a result of the employee teams' activities, CCL has saved over \$300,000 in scrap can reduction alone, and more than \$600,000 in waste reduction activities plant-wide.

c. *CCL Custom Manufacturing - Danville*

HWRIC visited CCL's Danville plant to re-present their certificate of recognition to all shift employees and plant management. CCL is a contract packager of liquid and aerosol products. The company was selected for this certificate based on their continuous improvement program. This program incorporated P² principles and established several teams of employees from all areas of the plant to address specific waste problems. HWRIC staff have been working with CCL over the past year to expand CCL's overall P² program.

d. *Hevi-Duty Electric - Mt. Vernon*

Hevi Duty Electric in Mt. Vernon was re-presented their award on the facility floor; all employees attended the ceremony. Hevi-Duty decommissions and remanufactures transformers of various types and sizes that contain polychlorinated biphenyls (PCBs, a hazardous waste compound). They were recognized with an award for their pollution prevention team known as RWASTE (Reduce Waste At Source 'Til Eliminated). The RWASTE team implemented several activities to reduce waste and to increase employee awareness of pollution prevention.

e. *Eaton Corporation - Lincoln*

An award re-presentation ceremony was conducted at Eaton's Lincoln facility. Eaton manufactures electrical breakers and enclosures for both residential and industrial use. Eaton was awarded a certificate of recognition for replacing their liquid dip paint system with an electrostatic powder coating system, which reduced waste in several ways.

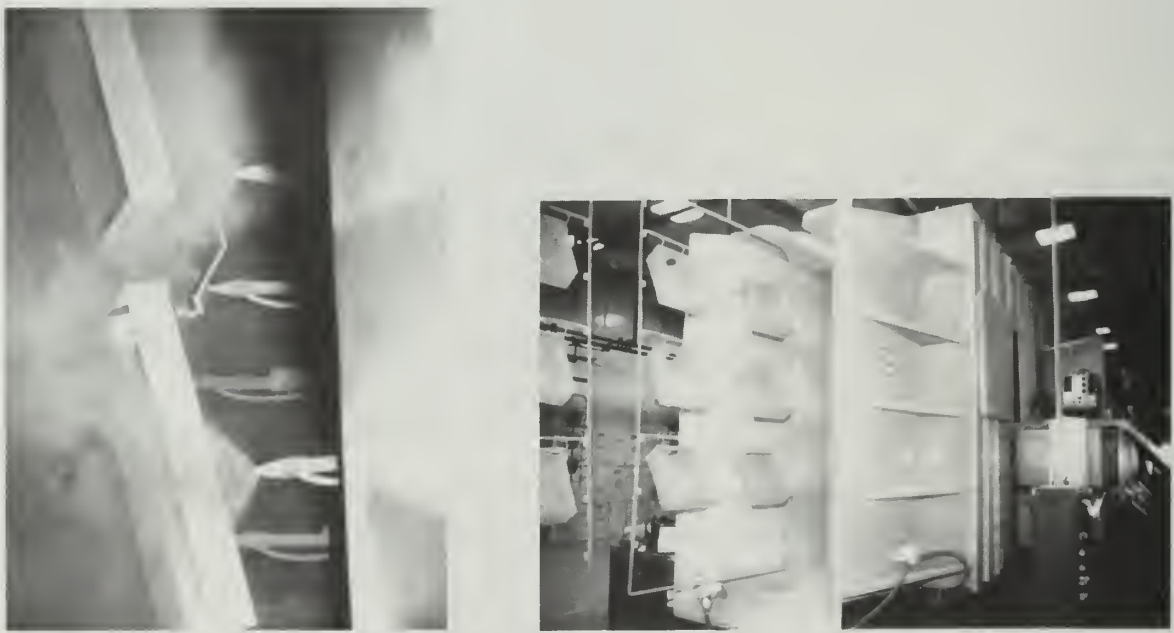


FIGURE 3-7: THE POWDER COAT LINE AT EATON — LEFT, CLOSE-UP, RIGHT, THE LINE

The powder coating system eliminates the liquid waste that was created in the dip system, and which required special hauling to disposal sites. Also, the new process at Eaton uses no solvents, thus eliminating solvent sludge waste which can ultimately be harmful to the ozone layer and must be properly disposed of. The certificate for Eaton was re-presented to members of the powder coating implementation team consisting of union representatives, engineers, and management.

3. Seventh Annual Governor's Pollution Prevention Awards

Early in 1993, HWRIC P² staff began coordinating the Seventh Annual Governor's Pollution Prevention Awards for activities completed in 1992. HWRIC is responsible for distributing applications, assisting potential applicants with completing the applications, evaluating the applications for technical merit, and coordinating the awards ceremony with the Governor's Office.

The application for the seventh annual awards was revised from previous years to reflect more emphasis on true pollution prevention projects, program development and implementation, and outreach and educational activities.

Applications were judged on the following criteria:

- Project/program/technology
- Waste volume/toxicity reduction
- Management commitment
- Employee participation
- Economic benefits
- Benefits to workers, community, environment, and
- Relevance to others

HWRIC received 40 applications in FY'92 for the seventh annual awards to be presented in the fall of 1993.

Although fewer applications were received for FY'93 than for the FY'92 program, the quality of the applications greatly improved and featured more true pollution prevention projects and programs.

TABLE 3-4: 1983 AWARD RECOMMENDATIONS

<i>Seventh Annual Pollution Prevention Award Recommendations</i>		
Category	Number of Awards	Number of Certificates
Community	1	1
Educational	1	0
Trade organization	0	1
Vendor	1	1
Small facility	1	1
Medium facility	2	1
Large facility	2*	1
*One of the awards will be shared by two divisions of the same company		

D. Citizens and Communities

1. Technical assistance and information

As shown in Table 3-1 in the Introduction to this Chapter, over 580 citizens and communities (including local governments and interest groups) requested various types of information from the Center during FY'93. Over 1,100 publications — including reports, factsheets and brochures — were distributed to citizens and communities in FY'93..

One of the main topics of concern to citizens and community organizations is what to do with household hazardous wastes. During the past year, HWRIC received over 100 requests for information on this topic including questions on: what household materials can present hazards; how to handle them; and, how to properly dispose of these materials. In response to many of these requests, HWRIC staff were able to give callers information about household hazardous waste collection events around the state.

In another outreach effort, HWRIC developed a factsheet on antifreeze, geared specifically for citizens. The factsheet includes household tips on proper waste management and handling of antifreeze, as well as steps to be taken if a child or pet accidentally ingests antifreeze, see Figure 3-8 below.

2. 1992 Illinois State Fair

Each year, HWRIC prepares an informative display as part of the ENR exhibit at the Illinois State Fair. Through this effort, hundreds of citizens are given pertinent information on waste management and prevention issues. The HWRIC display at the 1992 Illinois State Fair focused on household hazardous waste. Two posters were produced and displayed. One poster defined household hazardous wastes and the other provided suggestions on alternatives to replace common hazardous household products.

Handouts distributed at the fair included a set of eight recipe cards for making alternative cleaning products, a middle or high school level classroom activity on product life cycle analysis, and general information brochures on HWRIC. A variety of teachers contacted HWRIC during and after the fair indicating they intended to use the materials in their science classes.

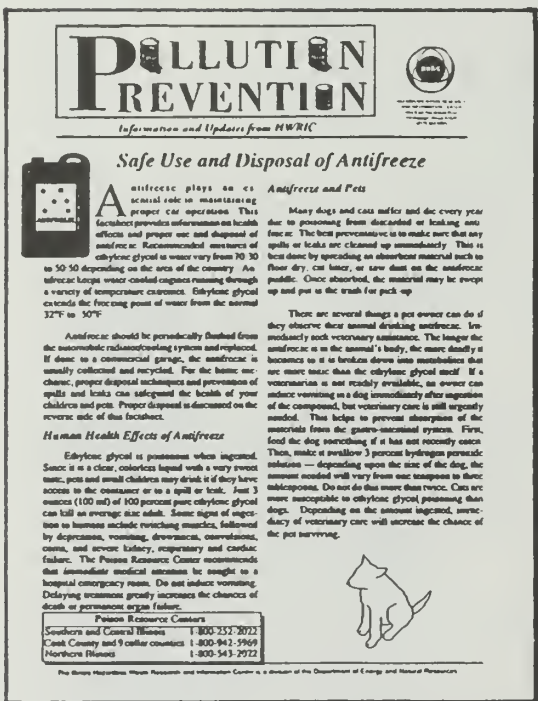


FIGURE 3-8: HWRIC FACTSHEET TN93-026

3. Hazardous Waste Database Aids Responses

HWRIC's hazardous waste database is used to identify sites of potential concern at or near properties being sold. Interest in this type of information has increased in Illinois since the adoption of the Illinois *Responsible Property Transfer Act* (PA 85-1228, effective in 1990). This law requires that the parties involved in a real estate transaction make the buyer aware of the environmental condition of the property.

HWRIC staff search the database for location information on landfills, surface impoundments and other types of disposal sites in response to requests from individuals conducting preliminary property site assessments. Over 60 such requests were completed in FY'93; one example of a request response follows.

HWRIC staff assisted a citizen who was helping the Boy Scouts of America search for waste disposal sites near a camping area the Scouts were considering purchasing. A search of HWRIC hazardous waste computer database files revealed that there was a disposal area on the camp property itself. Further investigation revealed that the site had been cleaned and was no longer considered dangerous.

4. Chicago Botanic Gardens Symposium

Several staff made presentations at the symposium "*Science Connections - Environmental Challenges in Northeastern Illinois*," held at the Chicago Botanic Gardens in March 1993. The symposium was organized by the Nature of Illinois Foundation for citizens in that area of the state. Topics presented by HWRIC's speakers included the benefits of pollution prevention, and, some results of HWRIC-sponsored investigations in the Lake Calumet area.

E. Educational Institutions

During FY'93, HWRIC received 231 requests for assistance or information from various educational institutions in Illinois. Over 930 publications from HWRIC's Clearinghouse were supplied to these institutions in response to requests. On several occasions, HWRIC staff made presentations at universities and secondary schools. (Presentations are listed in detail in Appendix A.) Staff also provided tours of the HWRIC facility to various student and teacher groups throughout the year. Examples of the types of assistance activities conducted with educational institutions in FY'93 are described below.

1. Middle School Chemistry Department

HWRIC personnel inventoried the stockroom of the chemistry laboratory at an Illinois middle school to determine if dangerous materials were present, if any materials should be removed, and if generally unsafe conditions existed. The inventory revealed few extremely hazardous materials, but did reveal some unsafe storage conditions which were subsequently corrected.

HWRIC personnel also found that the fire extinguisher that was present was not appropriate for use on some of the chemicals in the stock room.

2. University Class Lectures

HWRIC's Assistant Director presented a lecture on "Overview of Hazards and Toxics" at the UIUC campus. This presentation was part of a guest lecture series for an Honors Program class entitled "Environmental Quality: Social and Technical Solutions and Realities." He presented another lecture, "Hazardous Waste Treatment," at Southern Illinois University's Carbondale campus. This lecture was for an undergraduate environmental chemistry course.

3. Educational Factsheet

A factsheet, *Environmental Activities for the Classroom: Product Life-Cycle Analysis*, (see Figure 3-9) for secondary education teachers was produced in part for the 1992 State Fair (see Section D.2 of this Chapter). This publication is intended to raise students' awareness about products they purchase which may have an impact on the environment beyond that of packaging disposal or wastes generated during use.

4. University Curricula Development Projects

Five projects have been funded by HWRIC's Research Program to develop pollution prevention curricula and other tools for universities to reduce waste from their research and teaching laboratories. The projects funded are:

- *Illinois Higher Education Survey*
- *Automated Database Tracking of Chemical Usage at the University of Illinois*
- *Determination, Implementation, and Evaluation of Laboratory Waste Minimization Opportunities*
- *Pollution Prevention Course at the Illinois Institute of Technology*
- *Pollution Prevention and Total Quality Management: Curricula for Schools of Business and Public Health at Illinois State University (ISU).*

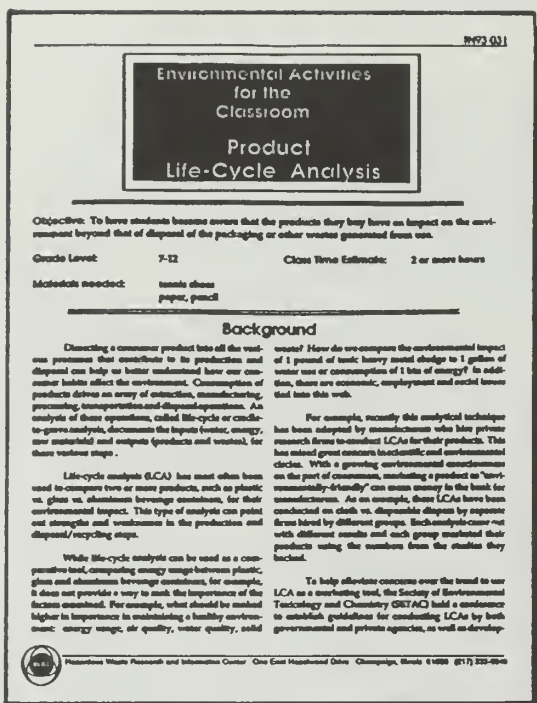


FIGURE 3-9: HWRIC FACTSHEET TN93-031

The survey of Illinois Higher Education institutions' waste management practices is being conducted in two phases by the University of Illinois' Survey Research Laboratory. The first phase objective, which has been completed, was to obtain information on the existence of waste management practices at 50 Illinois institutions of higher learning, identify a contact at the institution who was familiar with their waste management practices, and request information on their technical assistance needs. The responses included many requests for regulatory assistance from HWRIC, such as information on environmental regulations, laboratory safety requirements, generator status, and permit requirements.

This first survey revealed that most universities do not have an adequate waste management program in place.

During the second phase of the project, a detailed questionnaire will be sent to identified individuals. Based on the results of the first survey, it was found that the amount of information available from most institutions on their waste management practices was much less than expected. This second survey, intended to obtain information on specific wastestreams generated, their source of generation, and how they are currently being treated or disposed, had to be redesigned and simplified as a result. The goal of this project is to use the survey information to identify source reduction techniques/technologies that can be adopted by these schools.

The project "*Determination, Implementation, and Evaluation of Laboratory Waste Minimization Opportunities*" documented existing laboratory practices at six different types of laboratories on the UIUC campus. The goal of the project was to identify common problems and find solutions that would reduce waste generation at the source. Principal investigator Peter Ashbrook and his staff evaluated chemical substitution, chemical recovery and reuse, chemical exchange, and ways to minimize chemical usage. The project team developed a self-administered audit to assist researchers and laboratory managers on the campus to assess and track their chemical usage and waste generation. Although the final project report will document problems and solutions to waste generation at UIUC chemistry laboratories, the recommendations will be applicable to universities and colleges throughout the state and country. The final report for this study should be available from HWRIC in spring 1994.

In the third project, "*Automated Database Tracking of Chemical Usage*," UIUC researcher Dr. John Ableson and his colleagues developed a personal computer-based program to track the flow of chemicals through a campus department. The automated system is designed to facilitate waste minimization by eliminating unnecessary duplication in purchasing chemicals, encouraging internal recycling of unused chemicals, and fostering improved waste disposal practices.

The database has been tested successfully in the UIUC Department of Civil Engineering. HWRIC has granted the researchers' request for additional funding to install the program in other departments at UIUC as well as at other

institutions. The year of testing in different laboratories and departments with different needs will allow for refinement of the database program.

For one of the university curriculum projects, Illinois State University (ISU) faculty will prepare four course modules to introduce pollution prevention principles combined with total quality management (TQM) concepts to seniors in schools of business and public health. The modules will be designed to be easily modified so that they can be used by businesses for employee training. These three one-hour modules will be evaluated during actual classroom use, feedback from the students and peer review by the staff of ISU's Center for Environmental Education.

The other curriculum project involves designing a course in pollution prevention for graduate students in engineering. The course will be included in the Fall, 1993 syllabus for graduate engineering students at Illinois Institute of Technology (IIT). As part of the proposed course, IIT students will learn how to perform a P² assessment and then will use this knowledge to document pollution prevention activities at companies in the Chicago area.

Both curricula development projects are scheduled for completion by June 1994. Final project reports will include course lesson plans and copies of all materials used in the classes and modules, and will be made available to other universities in the state.

5. Informative Seminars

In the fall of 1992, HWRIC initiated a monthly "brown bag" noon seminar series for the purposes of facilitating the dissemination of information on

<i>FY 1993 HWRIC Brown Bag Seminars</i>		
October 13	<i>Organic Composition of Municipal Landfill Leachates and the Potential for Groundwater Contamination</i>	Dr. Peter Gintautus Postdoctoral Fellow, HWRIC
November 10	<i>Investigation of a Single Process which Strips Volatile Organic Compounds and Solidifies Heavy Metals Associated with a Contaminated Soil</i>	Brian Terando and Debbie Savaiano Project Assistants, HWRIC
December 8	<i>Promoting Pollution Prevention - Illinois and Nationally</i>	Dr. David Thomas Director, HWRIC
February 9	<i>Deposition of Air Toxics in the Great Lakes</i>	Dr. Clyde Sweet Illinois State Water Survey
March 16	<i>Crab Orchard Refuge: The Final Chapter</i>	Dr. Stephen Vermette Illinois State Water Survey
April 13	<i>Oil and Grease in Surfactant-Laden Wastewaters: Pollution Prevention and Analytical Chemistry Perspectives</i>	Jack Cochran and Tim Lindsey HWRIC
May 11	<i>Validation of Metal Speciation Methods for Soils: Myths and Fables or Meaningful Results?</i>	Dr. Peter Gintautus Postdoctoral Fellow, HWRIC

FIGURE 3-10: NEW FY'93 SEMINAR SERIES

hazardous waste and promoting cooperative research among those in the scientific community. The seminars presented in FY'93 are listed in Figure 3-10 on the previous page.

6. Soy Oil-based Ink Evaluation in Printing

HWRIC's staff and staff at the UIUC Office of Printing Services undertook an evaluation of soy oil-based inks in their presses as an alternative to petroleum oil-based inks. The soy oil-based inks are thought to produce less toxic air emissions. The purpose of the study was to quantify the waste reduction and economic impacts of switching to these inks. This was the first time that in-plant measurements of wastes generated from two similar runs, each using different inks, have been made. The results of this testing are being analyzed and will be published in a report to the USEPA in the fall of 1994.

Printing Services staff also requested assistance from HWRIC to quantify and characterize some other wastes generated in their printing operations. Chemical analysis was conducted on several liquid wastes from their plate and photo developers and fountain solutions. The results of this testing are being used by the University to better manage their operations.

Chapter IV: Collaborative Efforts

A. Introduction

To carry out its mandates, HWRIC has found it necessary to network with other groups and obtain outside funding. Thus, HWRIC enters into numerous collaborative efforts with governmental, business, and private interests during the course of a year. These activities range from participating on committees and cosponsoring conferences to working with others on research and demonstration projects. This cooperation allows the participants to access each other's expertise without costly duplication of effort, and helps maintain an informal exchange of ideas. Below are examples of some of these collaborative efforts. More details about some of these projects can be found throughout this annual report.

B. Federally Funded Projects

1. Waste Reduction Advisory System (WRAS)

Over the past three years, HWRIC has received funding from the USEPA to work cooperatively with other states, the United Nations, and with USEPA to develop a database of pollution prevention case studies. This project is intended to integrate HWRIC's WRAS with USEPA's Pollution Prevention Information Exchange System (PIES). This cooperative project will give HWRIC and Illinois businesses improved access to national and international information about current pollution prevention technologies. The WRAS contains a pollution prevention assessment checklist and a bibliography of literature and case studies related to pollution prevention.

The WRAS Computer program is available from the HWRIC Clearinghouse on a 3.5 " or 5.25" diskette for \$90.00, prepaid.

The PIES, housed on a USEPA central computer with dial access, contains literature and case study bibliographies plus several other features. The main goals of the project are to integrate the WRAS and PIES databases, and to add to the number and improve the quality of case study abstracts. The goals will be achieved by the fall of 1993, despite the fact that the project received only partial funding.

2. Waste Reduction Innovative Technology Evaluation Program

Evaluations of five pollution prevention technologies have been completed with funding from the USEPA under the ILLINOIS/USEPA Waste Reduction Innovative Technology Evaluation (WRITE) Program. WRITE was a pilot

cooperative program between the federal government, state government and industry. The five projects undertaken by HWRIC were:

- Hazardous waste reduction for a commercial iron phosphatizing/degreasing bath (R.B. White Inc., Bloomington)
- Evaluation of the effectiveness of low temperature evaporation and reverse osmosis for chemical recycling/reuse of electroplating rinsewaters (Graham Plating Co., Chicago)
- Substitution of alkaline zinc for cyanide zinc and in-process zinc recycling in electroplating (P&H Plating, Chicago)
- Water-based ink and cleaner waste reduction evaluation for a flexographic printer (MPI Label Systems, University Park)
- Soy and petroleum based ink waste reduction evaluation for sheet-fed offset printers (University of Illinois, Urbana-Champaign)

These projects were among the earliest pollution prevention studies undertaken cooperatively between government agencies and businesses. In each case, in-plant measurements were taken to evaluate the effects on waste generation by potential pollution prevention technologies. The results can be useful to similar companies considering what pollution prevention options are most effective for them. In addition to these technology evaluations, the engineer and graduate student staff funded on this project have provided technical assistance to other companies throughout Illinois.

3. Non-hazardous Industrial Waste Research

HWRIC has two Industrial-D (non-hazardous) Waste projects funded by USEPA. One involves conducting on-site pollution prevention assessments at particular foundries with the ultimate goal of establishing pollution prevention (P²) practices within the industry.

The focus of the second project is to:

- Analyze data on non-hazardous industrial wastes generated, stored, or disposed of in Illinois,
- Assess the risk associated with those wastes, and
- Propose a format for a national database of non-hazardous industrial wastes.

For this project, HWRIC is working with the state of Pennsylvania to compare wastes produced in Illinois and Pennsylvania, and to assess the data the Pennsylvania program has collected in their existing database.

4. Pollution Prevention Incentives For States Grant

In 1990, IEPA was awarded a two-year USEPA Pollution Prevention Incentives for States Grant (PPIS) to assist in the implementation of the Illinois *Toxic Pollution Prevention Act* provisions and to promote pollution prevention throughout the state of Illinois.

As part of this grant, HWRIC performed the following tasks:

- Identified priority industry groups for pollution prevention assistance in the Chicago area
- Developed an Illinois pollution prevention guidance document
- Implemented pollution prevention technical assistance statewide, and
- Provided pollution prevention assistance and supported curriculum development for Illinois higher education institutions.

HWRIC's pollution prevention grant activities were coordinated with IEPA's pollution prevention staff.

For the industry assistance component of this project, HWRIC focused on the Chemical Industry Council of Illinois (CICI) and the Printing Industry Council of Illinois and Indiana. HWRIC staff worked with representatives of these trade associations to identify companies interested in the types of assistance Center staff can provide. This cooperation resulted in the Center assisting eleven facilities with their pollution prevention efforts.

This collaborative approach to P² activities by HWRIC and IEPA was designed to recognize and complement each agency's role in promoting pollution prevention in Illinois. HWRIC assisted IEPA with their pollution prevention conferences for Illinois industries, particularly those members of Illinois' Partners in Prevention Program. HWRIC has also been involved in training IEPA's interns on pollution prevention implementation and programs during the three years of the PPIS project.

There have been significant benefits from this grant. As a result of PPIS funding, HWRIC's educational outreach efforts and promotion of pollution prevention to Illinois industries, institutions, citizens and communities have greatly expanded and are generally welcomed.

C. Critical Trends Assessment Project

The overall theme of CTAP is "Critical Trends Assessment Project — Monitoring Illinois' Ecosystem"

A major collaborative effort undertaken by HWRIC through ENR during FY'93 was the Critical Trends Assessment Project (CTAP). Under the direction of the Governor's Office and the Governor's Science Advisory Committee (GSAC), the divisions of ENR developed a series of technical reports identifying how Illinois' citizens impact the environment and how these impacts have changed over time. These technical reports cover such topics as air resources, water resources, forests and prairies, and waste generation. During FY'94, a public document summarizing the most significant trends found in the CTAP will be released.

HWRIC's primary contribution to CTAP is collaboration with the State Geological Survey and ENR's Office of Research and Planning to prepare a technical report summarizing trends in waste generation and management. The focus is on solid wastes and the disposal of such wastes on land. HWRIC staff worked with ENR and Survey staff to develop an holistic approach to these issues. This approach required the use of information from a number of different sources including state agencies, literature research, and results from research projects sponsored by HWRIC.

Some significant issues identified in HWRIC's report about waste generation and management include:

- Companies, particularly small businesses, are finding it increasingly difficult to comply with environmental regulations because of the increase in the number and complexity of these laws. The number of environmental laws adopted nationally since 1970 has increased dramatically from less than 10 in 1970 to almost 100 in 1990.
- The national per capita generation rate of municipal solid waste increased from 2.66 pounds per person per day in 1960 to 4.3 pounds per person per day in 1990.
- Despite a sharp decline in the number of hospitals and hospital beds in Illinois between 1972 and 1989, the amount of medical waste generated increased, due to an increase in the use of disposable items in medical procedures.
- The number of landfills permitted to accept non-hazardous waste is expected to drop from 146 in 1987 to 64 by the end of 1993. The reported remaining capacity of these landfills has increased.
- *The Solid Waste Management Act* of 1986 has led to increased recycling efforts on the part of local governments. For example, the total tonnage of newsprint recycled in the town of McHenry rose from 153 in 1973 to 2,664 in 1991.

- Government is working to adopt and support more cooperative programs with industry such as pollution prevention assistance programs. These programs have moved the emphasis from end-of-pipe controls to in-plant preventative measures.

Potential solutions discussed in this CTAP report include: the emphasis on multi-media approaches toward environmental regulation; pollution prevention as a means to improve environmental quality and industrial competitiveness; and the remediation efforts in Illinois to clean up hazardous sites.

D. Analytical Support Activities for Other Agencies and Researchers

The HWRIC Laboratory Services Program (LSP) works collaboratively with researchers needing technical guidance and analytical assistance. During FY'93, the LSP engaged in several such projects. The program provided sampling guidance, analytical methods development, and analytical support to an environmental monitoring project conducted by Argonne National Laboratory. Program staff also engaged in methods enhancement and metals analysis on a Great Lakes rainfall monitoring effort being conducted by the State Water Survey.

The LSP continues to provide analytical and technical support to several projects funded by HWRIC's Research Program, including a contaminated soil treatment effort directed by Dr. Fitzpatrick at Northwestern University, and a PCB toxicological study headed by Dr. Larry Hansen at the University of Illinois.

The Program has engaged in a number of smaller scale efforts where lab staff have worked cooperatively to assist research efforts at the Construction Engineering Research Lab of the US Army Corps of Engineers in Champaign, at the State Water Survey, and with the in-house efforts of the Pollution Prevention Program.

E. Coordination with Other Government Agencies

1. Annual Pollution Prevention Conference

The third annual *Partners in Prevention* (PIP) Conference sponsored by IEPA and HWRIC was held October 26, 1992 at the Eagle Creek Resort at Lake Shelbyville. Several HWRIC staff members gave presentations at the conference (see Appendix A). The goal of the annual conference is to encourage industries to voluntarily reduce the volume and toxicity of wastes produced from their manufacturing processes. The goal of IEPA's Partners in Prevention program is to encourage companies to voluntarily commit to pollution prevention programs.

The PIP conference, which included pollution prevention seminars and concurrent break-out sessions, was attended by more than 120 representatives from a wide variety of industries.

2. Greater Chicago Pollution Prevention Project

HWRIC is participating in a cooperative project with the Metropolitan Water Reclamation District of Greater Chicago (District), the City of Chicago Department of Environment (City), USEPA, and IEPA to provide pollution prevention education and technical assistance to industries in the Greater Chicago area. HWRIC staff are promoting pollution prevention for all media releases, targeting facilities which most seriously impact the District or which are recommended by state, federal and local partnerships to address risk. Industries will be encouraged to implement pollution prevention activities which increase economic competitiveness and efficiency.

The greater Chicago Project will encourage industries to implement pollution prevention activities which will increase economic competitiveness and efficiency.

As mentioned in Chapter III, during FY'93 three training sessions were held as part of this project. One was for electroplaters and the other two were for training staff from the District and the City in basic pollution prevention concepts.

In FY'94, this effort will be supported by a USEPA grant. Next year's tasks are to conduct outreach activities and to provide technical assistance to industries in the greater Chicago area. The scope includes educational programs as well as on-site pollution prevention assessments. The latter will be carried out by a contract-funded HWRIC employee who will be stationed at the District offices in Chicago.

3. State Department of Transportation Meetings

The Illinois Department of Transportation (IDOT) continued to hold a series of environmental regulatory compliance workshops at the HML. HWRIC staff helped facilitate the meetings and discussed small quantity generator regulations with the IDOT employees. A final session was presented at each workshop by an Illinois Department of Labor representative who spoke on worker right-to-know laws.

4. Great Lakes Regional Coordination

HWRIC began production of a pollution prevention newsletter entitled *LINK* (Figure 4-1) early in 1992 for USEPA Region V member states (Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin). The goal of the newsletter was to foster cooperation and coordination of these states' pollution prevention efforts and to encourage technology transfer.

A network of *LINK* contributors from each state's pollution prevention group(s) has been established. Three issues of the newsletter have been distributed this year. Topics covered included updates from the various programs on their pollution prevention activities, a calendar of events, case studies, and a lead article. HWRIC is anticipating receipt of funding from USEPA to continue *LINK* in FY'94.

5. Illinois Battery Task Force

The Illinois Battery Task Force, formed by the General Assembly to examine problems related to the use and disposal of batteries from consumer electrical products, included HWRIC personnel.

After a short educational period during which task force members learned about the types and quantities of batteries used by consumers, a variety of topics were considered at several meetings. This included discussions on appropriate management methods for the various types of batteries, whether certain types of batteries should be banned from the marketplace, and whether certain types of batteries should carry markings indicating their recyclability. A written report required by the legislature is being prepared by ENR's Office of Recycling and Waste Reduction and will be reviewed by HWRIC's Regulatory Assistance Engineer.

6. Information Services

A peer-reviewed poster session — "Three State Agency Libraries Combine Expertise to Make Natural Resource and Environmental Information Available" — was presented at the annual Illinois Library Association conference (April 13, 1993, Springfield) by The Geological and Water Survey Librarians, and HWRIC's Information Services Program Manager/Librarian. The display used the polluted Crab Orchard area to illustrate the breadth of printed, data, and map resources that these divisions of ENR can provide.

HWRIC's Information Services Manager/Librarian co-authored a paper with the Water Survey Librarian about hazardous waste reference tools (see citation at right). The paper reviews sources (print, online, hotline, etc.) that would be beneficial to include when building a library collection in the hazardous waste subject area.

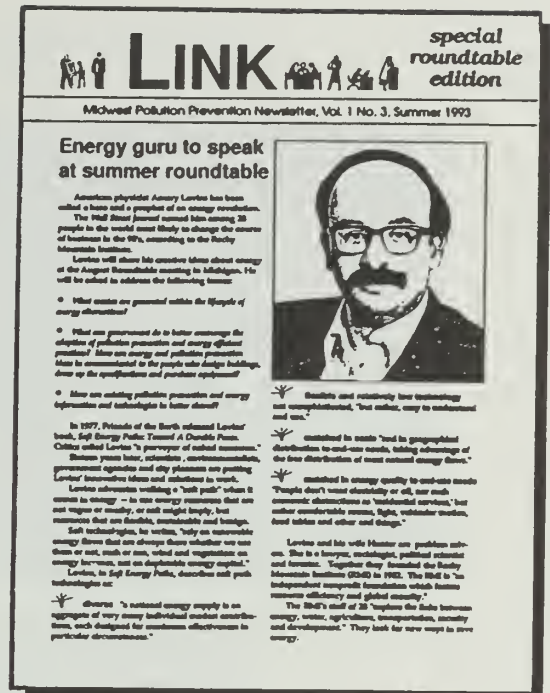


FIGURE 4-1: LINK NEWSLETTER

Drone-Silvers, Frances and Sara Tompson. "Hazardous Waste Reference Resources" *Science & Technology Libraries* 13(2):65-74 (Winter 1992).

F. Coordination with Trade Associations

1. Valley Industrial Association

HWRIC is participating in an innovative partnership with the Valley Industrial Association (VIA) to promote pollution prevention and business competitiveness. VIA is a trade group with approximately 160 members located in the Fox River Valley of Illinois. Through a Technology Challenge Grant from the Illinois Department of Commerce and Community Affairs (DCCA), VIA is providing matching funds to member companies with less than 260 employees to improve or implement pollution prevention measures and to provide technical assistance to improve quality and productivity.

In the initial phase of the grant project, companies could utilize the services of HWRIC, an environmental attorney, an environmental engineering firm, and Waubensee Community College staff with expertise in the new ISO 9000 product quality standard as well as total quality management (TQM) techniques. Assistance would be provided to help companies determine their needs and to identify appropriate projects for funding. HWRIC's efforts in this partnership are described in detail in Chapter III of this report.

2. Fabricated Metals Industry

HWRIC hosted an April conference for companies interested in pollution prevention opportunities in the fabricated metals industry. The conference was sponsored by IRMCO, an Evanston manufacturer of synthetic metal stamping lubricants. Over 20 company representatives attended, including environmental managers, production supervisors and many plant managers.

3. Illinois Manufacturers Association

HWRIC participated in a two-day September conference held at the Rice campus of the Illinois Institute of Technology and sponsored by the Illinois Manufacturers' Association (IMA), with funding from ENR. HWRIC staff played an active role in the conference by making presentations and providing materials for participants including pollution prevention case studies.

HWRIC took the lead in sponsoring a statewide pollution prevention teleconference — "Water-Based Alternatives to Solvent Cleaning" — on February 11, 1993 at seven sites throughout the state. In Illinois, the event was cosponsored by IEPA, DCCA, and IMA. The teleconference, produced by the Cleveland Advanced Manufacturing Program and the Unified Technologies Center, was broadcast throughout the United States.

4. Collaborative Efforts with Foundries

With funding from USEPA, HWRIC conducted on-site pollution prevention assessments at three foundries in Illinois. These foundries were selected in cooperation with the American Foundrymen's Society and the Illinois Cast Metals Association.

A detailed two-day pollution prevention assessment was conducted at Vermillion Iron Works, a foundry in Hoopston. A presentation on pollution prevention program implementation was made to the company president, supervisors, and a union representative at Excelsior Foundry, in Belleville. A detailed one-day pollution prevention assessment was also conducted. HWRIC staff also visited Bay City Steel Casting Foundry to discuss pollution prevention strategies (see Figure 4-2).



FIGURE 4-2: BAY CITY STEEL CASTING FOUNDRY VISITED BY HWRIC PROJECT STAFF

The goal of this project was to assess current pollution prevention practices of typical foundries and to document current pollution prevention activities in the industry. During these assessments, effective pollution prevention practices were identified at some companies while for others there appeared to be reasonable steps the companies could take to modernize and reduce waste generation. These recommendations will be passed on to the foundries in a final report.

Over the past four or five years, HWRIC has undertaken a number of projects with the Des Plaines-based American Foundrymen's Society. One HWRIC-sponsored research project resulted in publication of a report in FY'93 titled "*Waste Management Study of Foundries' Major Waste Streams: Phase I*" (Report TR-011, available from the HWRIC Clearinghouse). Sources and characteristics of wastes generated during various foundry operations were identified in the study. Subsequent phases of the project will identify technologies available to minimize, recycle, reuse, and treat each of these wastes.

G. Public and Private Coordination Efforts

1. "Science Connections — Environmental Challenges in Northeastern Illinois"

This was the title of the Chicago Botanic Garden's symposium held on March 27, 1993. The symposium was organized by the Nature of Illinois Foundation, and was designed to introduce the Illinois Scientific Surveys and HWRIC to the

people of the area, particularly patrons and supporters of the Gardens. The meeting presented an opportunity for the Surveys' and HWRIC's scientists to describe and discuss the research activities they had undertaken in the northeastern portion of Illinois.

2. Nature of Illinois Foundation

The Nature of Illinois Foundation (NIF) is a membership organization the goal of which is to support and promote the work of the state's Scientific Surveys and HWRIC. Of benefit to both members and HWRIC is NIF's quarterly newsletter publication "*The Nature of Illinois*." The newsletter highlights activities undertaken by the Surveys and HWRIC and provides these organizations with public outreach and increasing public awareness of current research and issues concerning Illinois' environment.

The 1993 issues of "*The Nature of Illinois*" contained the following articles on HWRIC:

- "*Pollution Prevention Awards*" (Winter, 1993, p. 12)
- "*Paint Disposal Study Presented*" (Winter, 1993, p. 12)
- "*HWRIC Director Elected to Head Advisory Board*" (Winter, 1993, p. 12)
- "*Business and the Environment*" (Summer, 1993, p. 6)
- "*A Legacy of Historic Disposal Practices*" (Summer, 1993, p. 7)
- "*Profile of a Scientist—Dr. Marvin Piwoni*" (Summer, 1993, p. 8)
- "*HWRIC Works With Printers for Better Solutions*" (Fall, 1993, p. 3)
- "*Governor's Pollution Prevention Awards*" (Fall, 1993, p. 6)

Collaboration with NIF extends beyond the newsletter. In February, NIF provided tours of Scientific Survey and HWRIC facilities for interested state legislators and legislative staff. NIF also cosponsors seminars and workshops that provide scientific information to the public.

3. Pollution Prevention Roundtables

As more states implemented pollution prevention programs in the past few years, it became obvious that an association was needed to foster communication and the exchange of information between the programs. A Roundtable of state technical assistance and waste reduction programs was formed in 1985. In 1990, it became the National Roundtable of State Pollution Prevention Programs. HWRIC Director David L. Thomas was a part of the original governing Board of the Roundtable and became Chair of the Board of Directors in the fall of 1992 when it became a tax exempt nonprofit organization. The National Roundtable of State Pollution Prevention Programs promotes the development, implementation and evaluation of efforts to avoid, eliminate, or reduce waste generation to all media (air, water and land).

The Midwest Pollution Prevention Roundtable brings together representatives from both non-regulatory and regulatory pollution prevention programs from the states in USEPA Region V (Illinois, Indiana, Iowa, Ohio, Michigan,

Minnesota and Wisconsin), the province of Ontario, and some other neighboring states such as Iowa. HWRIC helped found the Midwest Roundtable in the mid-1980s. The semi-annual meetings of programs and discussions have included staff from USEPA as well as Roundtable members and occasional guest presenters.

4. Groundwater Protection Education

Two HWRIC staff members participated in the Groundwater Protection Day Fair organized by ENR and held at Southern Illinois University's Edwardsville campus on May 7th, 1993. HWRIC staff created a display on oil and solvent recycling included a sample oil collection station as well as a solvent still from HWRIC's pilot lab. The still is used on oil contaminated-solvents, separating the components so the oil can be discarded and the solvent reused. The Fair was organized for farmers and other citizens interested in groundwater protection issues.

Chapter V: Research and Development

A. Introduction

Chapters III and IV of this report discussed the Center's interactions with citizens, communities, industry, educational institutions, and other state and federal agencies. These contacts ranged from simply providing information to technology evaluations and in-plant modifications. Many of these outreach efforts were successful because of completed and on-going research funded through HWRIC's Research Program, as well as externally funded projects conducted by HWRIC's staff. During FY'93, HWRIC's research priority continued to be pollution prevention; however, investigations that characterized environmental problems and their risks and that described and evaluated remediation technologies were also undertaken.

The Center's research and development activities are directed toward addressing the full spectrum of issues surrounding the management of wastes. The environmental implications of historical management practices are apparent from the number of hazardous waste sites awaiting cleanup in the state and the extent of the contamination problems at the sites. Through research, HWRIC has sought ways to solve current problems, such as remediation of waste sites, as well as ways to prevent these problems from recurring.

State resources have also been used to fund external researchers exploring new waste management options or modifications to existing practices. Included in this type of research effort are the pollution prevention technology development and demonstration projects discussed in Chapter III of this report. Center staff have obtained additional funding from both private, federal, and other state sources to conduct their own investigations of waste problems and possible solutions. Several of these projects are discussed later in this Chapter. Descriptions of most completed research efforts funded by HWRIC or conducted by Center staff are prepared and used to respond to information and assistance requests.

In FY'93, HWRIC's Research Program supported 10 new projects and 18 continuing ones. New projects were selected from responses to HWRIC's two annual solicitations (see Chapter II). The two most important criteria in the selection process are the relevance of the proposed work to the critical waste management problems facing Illinois, and the likelihood that the proposed project will be successful. Applicability of the study findings to other similar organizations or industries was also considered during the proposal evaluations. Several of the projects chosen for funding in FY'93 are discussed in the following paragraphs.

Published documents -- reports, factsheets, etc. -- on most of the research projects undertaken by and for the Center are available from the HWRIC Clearinghouse.

B. HWRIC-Funded Research

Ten of the 28 Center-funded FY'93 projects were completed by the end of June 1993. Table 5-1 below lists those projects and the anticipated availability of the project reports. Project reports published during the year are listed in Table 5-2 on the following page. Projects that began in FY'93 (or earlier) and will continue through FY'94 are listed in Table 5-3 on pages 4-5. Brief summaries of all of these projects are included in this report as Appendix C.

TABLE 5-1: FINISHED RESEARCH PROJECTS

Research Projects Completed in FY'93

Title	Principal Investigator/ Affiliation	Date Report Available
Speciation and Mobilization of Toxic Heavy Metal Ions by Methanogenic Bacteria	Neiderhoffer/Koropchak Southern Illinois University @ Carbondale	Fall 1993
Evaluation of Methods for Tracking and Reporting the Presence of Special Waste from Commercial Sources	Freeman/Solar Environmental Services, Inc.	Winter 1994
Automated Database Tracking of Chemical Usage at the University of Illinois at Urbana-Champaign (UIUC)	Abelson/Fisk University of Illinois @ Urbana- Champaign	Winter 1994
Die Lubricant Waste Reduction at OMC's Facility	Montemurro/Outboard Marine Corporation	Spring 1994
Biological Treatment of a Manufactured Gas Plant Soil	Pederson/Remediation Technologies, Inc.	Spring 1994
Enhancement of the Degradative Potential of Microbial Isolates Enriched from Herbicide-Contaminated Soil	Felsot/Vossbrink/Illinois Natural History Survey Dzantor/Tennessee Valley Authority	Summer 1994
Use of Landfarming to Remediate Soil Contaminated with Pesticide Waste	Felsot/Illinois Natural History Survey Frank/Andrews Environmental Engineering	Summer 1994
Use of Char for Management of Paint Processing Waste	Kruse/Illinois State Geological Survey	Summer 1994
Restore Process for Refinery Sludge Treatment and Oil Recovery	Diab/U.S. Emulsion Technologies	NA*
Historical Context of Hazardous Waste Management	Colten/Illinois State Museum Society	NA*

*NA - Not applicable; project will not result in a published report

The projects selected can be grouped into three areas of emphasis:

- Pollution prevention promotion and implementation
- Remediation technology evaluation, and
- Assessment of risk to the environment and human health.

The investigators whose work was supported in FY'93 included representatives from:

- Public and private state universities
- The state Scientific Surveys
- Consulting firms
- Industry technical associations, and
- Small businesses.

TABLE 5-2: RESEARCH PROJECT REPORTS

FY'93 Research Reports and Technical Documents

Research Report Number Title	Author(s)	Publication Date
RR-062 Ecotoxicological Evaluation of Area 9 Landfill at Crab Orchard National Wildlife Refuge: Biological Impact and Residues	Michael J. McKee-Southern Illinois University, Cooperative Wildlife Research Laboratory	October 1992
RR-061 Rates of Microbial Dechlorination of Polychlorinated Biphenyls (PCB's) in Anaerobic Sediments from Waukegan Harbor	J.B. Risatti-Illinois State Geological Survey	August 1992
TR-011 Waste Management Study of Foundries Major Waste Streams: Phase I	Daniel Twarog-American Foundrymen's Society, Inc. and University of Alabama	November 1992
TR-010 Hazardous Waste Research and Information Center Inventory of Land-Based Disposal Sites, Document of the Use of the Software for Access to the Inventory, Ver. 1.0	Hazardous Waste Research and Information Center	October 1992
TR-009 Pollution Prevention: A Guide to Program Implementation	Hazardous Waste Research and Information Center	September 1992
TR-008 Paint Waste Reduction and Disposal Options Volume II-Site Visits	Center for Economics Research, Research Triangle Park and Research Associates	February 1993

1. Pollution Prevention Promotion and Implementation

HWRIC continued to work with educational institutions, industries, and communities to explore ways to promote the principals and practices of preventing pollution at its source as well as the importance of incorporating these concepts into the daily activities of schools, companies, and communities. One means of promoting these concepts is through formal instruction. This is the approach adopted by two education projects funded by HWRIC during FY'93 that will continue through FY'94.

TABLE 5-3 ONGOING RESEARCH PROJECTS

Title	Principal Investigator/ Affiliation	Project Duration (Years)	Project End Date
Characterization and Assessment			
Measurements of Indoor Toxic VOC Concentrations Attributed to the Residential Storage of Household Hazardous Waste	Sweet & Vermette - Buffalo St. Coll./ IL State Water Survey	3.5	6/94
Categorizing Major Waste Streams in Foundries	Twarog/American Foundrymen's Society, Inc.	2	10/94
Environmental Processes and Effects			
Impact of Fly Ash Disposal on Plant Development	Rayburn/University of IL @ Urbana-Champaign	3.75	6/95
Treatment, Disposal and Remediation			
An Investigation of Column Flotation Technologies for the Pretreatment and Volume Reduction of Fine Contaminated Soils and Sediments	FitzPatrick/Northwestern University	2	6/94
LUST Cleanup Technology Report	Wolterink/Perino Technical Services, Inc.	1.5	1/94
Identifying Site Specific Limitations to Successful In-Situ Bioremediation of Agricultural Retail Sites	Cole/University of IL @ Urbana-Champaign	2	9/94
Effect of Chemical Immersion on Interface Strengths of Hazardous Waste Landfill Liner Systems	Stark/University of IL @ Urbana-Champaign	2	6/95
Treatment of Spent Chemical Oxygen Demand Solutions for Safe Disposal	Holm/University of IL @ Urbana-Champaign	1.2	8/94
Waste Reduction			
Stabilization of Arsenic Nonwastewaters	Fuessle & Taylor/Bradley University	2	10/93
Course in Pollution Prevention	Anderson/Ill. Institute of Technology	1.2	8/94
Development and Pilot Demonstration of a Computerized Bar-Code Based Waste Tracking System for Waste Minimization at Argonne National Laboratory	Peters/Argonne National Laboratory	2	10/93
Pollution Prevention and Business Management, Curricula for Schools of Business and Public Health	Bierma/IL State University @ Normal	2	6/94
Waste Management Survey of Illinois Higher Education Institutions	O'Rourke/Survey Research Laboratory	3.5	2/94
Technology Transfer to Aid Pollution Prevention and Waste Management	Gwiasda/Survey Research Laboratory	1	6/94
Overcoming Barriers to Pollution Prevention in Small and Mid-Size Illinois Manufacturers	Bierma/IL State University @ Normal	1.5	12/94
An Analysis of Municipal Solid Waste Reduction Opportunities in Industrial/Commercial Distribution Networks	Snyder/Community Recycling Center-Champaign	1.2	8/94

Title	Principal Investigator/ Affiliation	Project Duration (Years)	Project End Date
Risk Assessment and Policy Analysis			
Determination of Animal Hazards from Air and Soil Samples from Crab Orchard	Hansen/University of IL @ Urbana-Champaign	3	6/95
Household Pets as Sentinels of Lead Exposure A Study of Lead Exposure, Phase II	Buck/University of IL @ Urbana-Champaign	4	6/95

"A Course in Pollution Prevention," being prepared by Dr. Paul Anderson of the Illinois Institute of Technology (IIT), is to be offered during the spring semester of 1994. The course is for graduate engineering students. It will focus on the principals of pollution prevention through the use of lectures by visiting experts in the field, printed case study examples, and student audits of companies requesting assistance in developing pollution prevention plans. HWRIC staff have provided Dr. Anderson with written materials for use in the course. Some HWRIC staff members will be giving several of the invited lectures, and may also work with some of the students during the audit phase of the class. At the completion of the project, the published report will contain the complete lesson plan for the course, including all printed materials, as well as an evaluation by Dr. Anderson of how well the concepts were assimilated by the students.

Another project, *"Pollution Prevention and Business Management — Curricula for Schools of Business and Public Health,"* will result in four instructional modules that can be used for undergraduate and graduate courses, as well as industry workshops. The modules will combine the principles of total quality management (TQM) with pollution prevention concepts. They are designed to first convince the student of the need and value of these concepts, then describe how the two ideologies complement each other, how they can be implemented, and how to evaluate their success.

These instructional pollution prevention curricula modules will be easy to adapt for several different audiences because of the general nature of the content.

These TQM/P² modules are being developed by Dr. Thomas Bierma of Illinois State University (ISU). Testing and refining of each modular unit will take place at ISU during the fall of 1993. The final report will contain the four modular lesson plans with suggested modifications to fit different audiences. This report, as well as the one for Dr. Anderson's study, should be available in the summer of 1994.

Two FY'93 Reduction and Recycling Technologies (RRT matching funds program) projects exemplify pollution prevention research with industry and the role HWRIC staff frequently play in Center-funded research. For the project *"Die Cast Oil Waste Reduction at Outboard Marine Corporation (OMC), Waukegan,"* HWRIC engineers worked with OMC personnel to evaluate ultrafiltration, vacuum evaporation, and atmospheric evaporation to reduce the volume of die cast and oily waste produced at the facility.

All three technologies successfully reduced the waste volume by at least 90%, as well as producing water that could be recycled in the new lubricant preparation. The company chose ultrafiltration over the other two methods for economic reasons. The payback period for the ultrafiltration unit was 1.2 years, which was 3.5 months sooner than the other two systems. The unit is now in full use at the Waukegan facility.

The second RRT project employed surface chemistry emulsion formation techniques to treat oily sludges from the bottoms of oil field, pipeline, and refinery tanks. For this project, *"Process Development for Treating Oily Waste Sludges and Recovering Oil,"* HWRIC's Pilot Laboratory engineers worked extensively with the researchers from U.S. Emulsion Technologies, Inc. (USET) to develop their oily sludge waste recovery process. The study to refine the three stage process was performed in HWRIC's Pilot Lab. The steps involved include:

- Emulsification of the sludge
- Centrifugation of the emulsified material to remove dirt, scale and other contaminants, and
- Further centrifugation to separate the oil from the water.

For the sludge used in the pilot study, the recovered oil was 98% pure and suitable for return to the refining process. The water was suitable for reuse, but would need further treatment, such as ultrafiltration, to be discharged to the sewer; and the solids were the only waste needing disposal (as hazardous waste). The process reduced the volume of waste that needed disposal to 9% of the original waste volume.

HWRIC engineers are working with USET to obtain federal support for the full scale testing of this waste recovery technology at a production site.

A third project that addresses industry's needs is entitled *"Use of Char for Management of Paint Processing Waste."* This project was undertaken by Dr. Carl Kruse of the Illinois State Geological Survey (SGS) and was jointly funded by Ford Motor Company and HWRIC. Dr. Kruse and his colleagues at the SGS have been successful in developing sorbent materials (chars) from coal. They were approached by Ford to see if a similar char could be produced from Ford paint waste solids and used as the sorbent in Ford paint spray booth -- reusing a waste from one process as part of another process at the same facility. While Dr. Kruse was successful in producing char from the dried paint waste, additional experimentation suggested that mixing the paint char and other more traditional chars would produce a more efficient sorbent material. Small quantities of the mixture have been produced and are being evaluated at Ford.

Although the process is successful, it is unlikely to be used by Ford for two reasons. The first is that the amount of paint waste needed to produce the paint char in quantities that Ford needs for paint booth sorbent is far more than that produced by the facility. Secondly, the sorbent materials the company now uses are collected by the manufacturer for reclamation and reuse. The SGS cannot offer that same service as it is not a commercial operation. The charring process results in a new waste that needs disposal -- the ash that remains after processing -- but it is a much smaller quantity of waste than the dried paint the company now must dispose. A report on the char project will be available in early 1994.

Pollution prevention options for the Champaign-Urbana community will be explored in Matthew Snyder's project, "*An Analysis of Municipal Solid Waste Reduction Opportunities in Industrial/Commercial Distribution Networks.*" Mr. Snyder, the director of the Community Recycling Center (CRC) in Champaign, will document CRC's attempts to work with local businesses to eliminate and/or reuse excessive packaging, particularly the repackaging of products by distribution centers. The report from this effort, which will discuss packaging options that result in less waste, could be beneficial to Illinois communities that are contending with increasing volumes of municipal solid waste and decreasing numbers of available landfills.

2. Remediation Technologies

Despite the increased efforts in Illinois to prevent pollution, industrial processes continue to produce wastes that need to be treated. Additionally, there are still numerous areas of known contamination throughout the state that must be handled, and new sites needing clean-up continue to be discovered. New technologies that are successful and economically comparable to, or better than, those in current use are needed to more effectively remediate all of these contaminated sites. It is important that HWRIC continue to support research on methods that will move contaminants to safe levels and will provide comparisons of these methods to those most commonly used, so that more informed clean-up decisions be made.

Remediation of waste sites is a critical issue for Illinois. The cost of cleaning up the average Superfund-identified waste site is now averaging \$20 million.

Because full scale remediation evaluations are costly, HWRIC has been limited in how much it can fund in this area. During FY'93, HWRIC-supported investigators working in the remediation area did the following:

- Explored a pretreatment technology for contaminated soils and sediments
- Evaluated the effectiveness of the remediation of pesticide waste through landfarming and the enhancement of indigenous bacterial populations
- Examined the limitations to *in situ* bioremediation of agrichemical sites, and
- Described the technologies available for remediation of sites contaminated by leaking underground storage tanks.

Agrichemical wastes are major problems for Illinois farming communities. (Figure 5-1 shows an agrichemical facility.) With funding from HWRIC and other governmental agencies, Dr. Alan Felsot, formerly of the Illinois Natural History Survey, has been investigating technologies to remediate soils contaminated by these wastes.

During FY'93, Dr. Felsot and his associates completed the field investigations for HWRIC-funded projects that studied two methods to treat these contaminated soils. For the project "*Enhancement of Degradative Potential of Microbial Isolates Enriched from Herbicide-Contaminated Soil*," Dr. Felsot and his associates developed a protocol to enrich, isolate, and screen bacteria and fungi for enhanced capabilities to degrade pesticides, particularly alachlor. They first studied the effects of soil dilution, alachlor concentration, soil characteristics, and nutrient amendments on the persistence of alachlor.



FIGURE 5-1: AN ILLINOIS AGRICHEMICAL PRODUCER SITE

The researchers then examined which soil factors might enhance biodegradation, explored the effects of biostimulants, and tested the feasibility of augmenting the soil with the enriched microbial isolates.

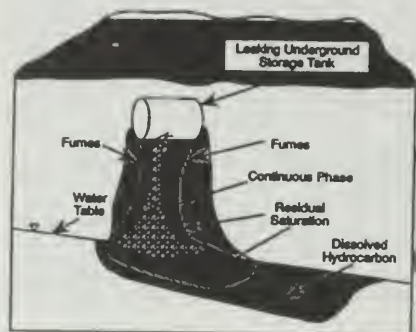
For the project "*Use of Landfarming to Remediate Soil Contaminated by Pesticide Waste*," Dr. Felsot's group sought to evaluate the practice of landfarming as an economically desirable and effective technique to clean contaminated soils from retail agricultural facilities. Landfarming involves spreading pesticide-containing soil on a crop field in place of a new application of pesticide. Landfarming reuses a chemical product, and is being studied to see if it also facilitates safe breakdown of pesticides in the environment. The investigators looked at the effect of pesticide loading and biostimulation on degradation rates, and characterized the toxicity of the landfarmed soils including their runoff and leachate. Data from both of these studies are undergoing final review. The feasibility of these two techniques will be discussed in detail in the final reports which should be available mid-1994.

Landfarming is also one of the remediation technologies described in the final report for the first phase of the project "*LUST Cleanup Technologies*." For this storage tank project, Dr. Janice Perino and her associates described technologies currently approved in Illinois for remediation of sites contaminated by the contents of leaking underground storage tanks (LUSTs). Once underground storage tanks begin to leak, their contents migrate through the soil, at times threatening public water supplies and other groundwater resources.

This first part of the project was to compare several IEPA-approved technologies for soil remediation, including excavation and landfilling, soil vapor extraction, bioremediation, thermal treatment and incineration, soil washing and flushing, solvent extraction, chemical dechlorination and *in situ* vitrification (using heat to solidify a waste and render it inert).

LUSTs are a serious problem for Illinois. Most LUSTs were used to store fuels and other petroleum products.

LUST Remediation Technologies
Part II
Soil Corrective Action Descriptions



by

Perino Technical Services, Inc.



Printed August 1993



FIGURE 5-2: HWRIC REPORT
RR-065 ON LUST CLEANUP

For each technology, the report provides a complete description of the process including design parameters and costs. The phase one report, "*LUST Remediation Technologies - Soil Corrective Action Descriptions*," is available from HWRIC's Clearinghouse (Report RR-065).

The second phase of the project, to prepare a similar document describing technologies for remediation of contaminated groundwaters, has just begun. This second report should be available in summer 1994.

3. Assessment of Risks to the Environment and Human Health

In previous years, Center-funded researchers characterized and quantified the extent of contamination problems in several highly populated areas of the state. East St. Louis area is one such area contending with the effects of years of heavy industrial activities. Previous HWRIC-funded studies focused on East St. Louis looked at the extent and sources of atmospheric pollution in this area.

During FY'92, HWRIC funded Dr. William Buck's project to explore the risks associated with an 80-year lead smelting operation in the Granite City area near St. Louis. His project, "*Household Pets as Monitors of Lead Exposure to Humans*," was conducted to determine the lead levels in children residing in the area and to correlate their blood lead levels to those measured in their pets. This work was undertaken as a collaborative effort with the U. S. Agency for Toxic Substances and Diseases Registry (ATSDR) and the Illinois Department of Public Health. Researchers at these agencies were quantifying blood lead levels in children and adults in the area. The source of lead for both studies was the soil.

Dr. Buck's study found that only 9% of the children tested had lead levels above the 10 $\mu\text{g}/\text{dl}$ (micrograms per deciliter) threshold established by the Centers for Disease Control, while 30% of the pets had levels above the threshold. This difference was attributable to the fact that the pets spent more time outside and subsequently had more exposure to the soil lead. There was a reasonable correlation between blood lead levels in children under 6 and those of their indoor pets. If a pet had high levels of lead in its blood, it was likely that one or more members of the household would also have elevated levels of lead.

Overall, the researchers concluded that the risk associated with environmental lead in this area was small. The study raised questions about the source of the high levels that were sometimes found in both the pet and human populations. Dr. Buck and his colleagues will use additional HWRIC funding to continue to look for answers, beginning with a study of the bioavailability of soil lead. The report from the pet sentinel study is in final preparation and should be available early in 1994.

The Crab Orchard Wildlife Refuge in Marion, declared a Superfund site in 1987, supports a mix of agricultural, industrial, and recreational uses. HWRIC has sponsored several investigations focusing on the polluted Crab Orchard area. A site for munitions manufacturing during World War II, Crab Orchard Refuge later supported metal fabrication and plating industries. Dumps were created on unused portions of the Refuge near the industrial activities to dispose of wastes generated by the industrial occupants. Compounding the problems created by industries producing and dumping metal wastes, from 1946 to 1962 the area was home to a company that produced electrical capacitors containing polychlorinated biphenyls (PCBs, a group of often toxic compounds).

During 1988, an assessment of the extent of the contamination in the Refuge was prepared. Thirty-three sites were identified as contaminated, with seven containing metal and /or PCB levels that posed a potential threat to the human and animal populations of the area. The USEPA has determined that these sites must be remediated. The initial efforts will focus on the four sites of PCB contamination, one of which is the Area 9 Landfill.

Over the last six years, HWRIC has sponsored several studies examining the risks posed by the Area 9 Landfill. The studies looked at contaminant levels in fish, benthos, and zooplankton, as well as lake sediments resulting from runoff from the landfill. This work showed that in general contaminants were at fairly low levels in the sediments and lower trophic organisms (those less complex and lower on the food chain). PCB levels in some fish species, however, did exceed the Food and Drug Association (FDA) recommended action level of 2ppm (two parts per million) in fillets.

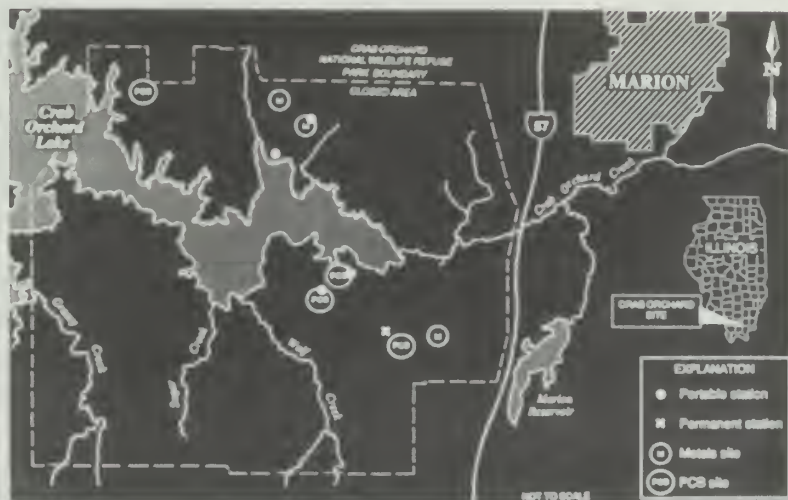


FIGURE 5-3: THE CRAB ORCHARD WILDLIFE REFUGE

A second study compared PCB and lead concentrations in the soil and biota living on or passing through Area 9 with concentrations at an uncontaminated control site on the Refuge. The abundance of many families of invertebrates was examined as a sign of a toxic response to soil contaminants. The concentrations of PCBs and lead varied considerably in the test sites, but the contaminants were always found in significant levels in Area 9 soils.

PCBs were present at high levels in both the invertebrates and the small mammal populations. Bioaccumulation of lead was not observed in the invertebrates but was in the small mammals. The density and diversity of the invertebrate population from both Area 9 and from the control site were comparable. This indicates that invertebrates can tolerate relatively high concentrations of PCBs and lead in their environments. Transfer of these contaminants through the food chain to higher trophic levels is evident, and poses increased health and survival risks to these higher organisms who have lower contaminant tolerances.

USEPA and the US Fish and Wildlife Service (the Service manages the Crab Orchard Wildlife Refuge) supported investigations from 1990-1992 to determine which remediation alternatives would be used at the seven sites designated for clean-up. Incineration was chosen for destruction of PCBs and solidification/stabilization for rendering the metal contaminants inert. Area residents, however, were concerned about possible risks from products of incomplete combustion that might be released to the air during incineration. These residents were very vocal in their objections to incineration and obtained financial support from the state to examine incineration and explore other options for remediation of PCBs at the Refuge.



FIGURE 5-4: AIR SAMPLING AT CRAB ORCHARD

HWRIC was approached by this group of residents and by IEPA to assess the existing levels of PCBs in the air above and near the refuge. Dr. Stephen Vermette, formerly with the Illinois State Water Survey (SWS), performed this assessment for HWRIC. He determined background levels of PCBs in the air that could be used to compare with levels found to exist while the remediation efforts were in progress.

Dr. Vermette sampled the air above four sites: the Area 9 Landfill, a second similarly contaminated site, a moderately contaminated site, and a clean site closer to the recreational areas and residences and some distance from the other three test sites. The study included an examination of the particles in the air, most importantly those less than 10 μm , which can be inhaled.

Once remediation activities begin at Crab Orchard, they will likely result in increased particulate matter in the air. It was therefore important to determine the concentrations of PCBs surrounding the agitated soil of the landfill. Air samples from directly over the areas of contamination had elevated PCB levels, but the PCB concentrations decreased rapidly as the sampling distance from the contaminated site increased. The report for this study is undergoing final review and should be available in early 1994.

Dr. Larry Hansen's project entitled "*Determination of Animal Hazards from PCB-Contaminated Air and Soil Samples from Crab Orchard National Wildlife Refuge using Planarian and Rat Bioassay Systems*" is the most recent HWRIC-sponsored effort at Crab Orchard. Hansen is using standard bioassay methods to identify and characterize potential hazards associated with the soil, dust, and air from the Refuge. A dose-response assessment will be prepared, and sample extracts will be used to determine tumorigenesis, neurotoxicity, and reproductive and developmental toxicity in both planaria and rats. Samples are being analyzed by HWRIC laboratory services staff to identify the PCB congeners and measure congener concentrations in the extracts. This project continues through FY'94.

C. HWRIC-Conducted Research

Research needs of the state in the areas of remediation, treatment, pollution prevention and risk assessment greatly exceed the Center's research budget. HWRIC staff have actively sought outside funding to undertake additional projects that will add to the knowledge obtained from previous projects and will provide efficient and practical solutions to existing waste problems.

Some of these research efforts have already been mentioned in Chapters III and IV. Additional examples of HWRIC's research activities are provided in the next few pages.

HWRIC has been awarded several contracts by USEPA to promote pollution prevention in the state. As a participant in USEPA's Waste Reduction Innovative Technology Evaluation (WRITE) Program, the Center:

- Evaluated three recovery/recycle technologies for use in electroplating operations
- Worked with two printing operations to document the benefits of using less toxic inks, and
- Explored the use of ultrafiltration to reduce waste and prolong bath life for metal cleaning operations (more details on all in Chapter IV).

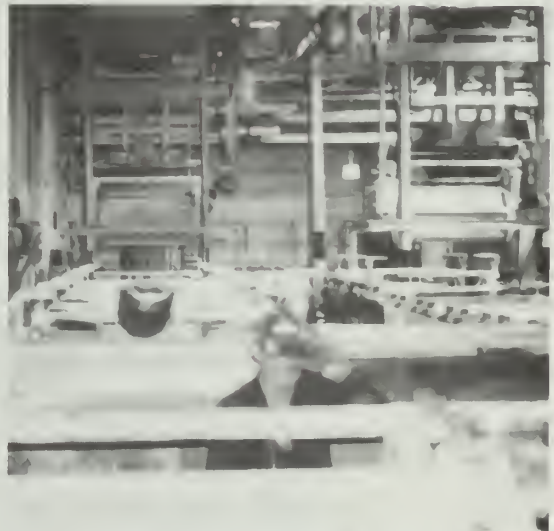


FIGURE 5-5: PLATING LINE AT PLANT VISITED DURING USEPA WRITE PROJECT

Summaries of the reports describing the process changes implemented in these evaluation projects, and the environmental and economic benefits of those changes, are available from USEPA for three of the evaluations. Two other reports are in preparation for submission.

For another USEPA-funded project, HWRIC joined with IEPA to assist industries in the Chicago Metropolitan area with prevention activities (see Chapter IV). Center staff worked with chemical and printing associations to find companies in need of assistance and willing to participate in the project. Project staff visited several companies and prepared evaluations of their existing pollution prevention activities. The assessment team's report offered suggestions to introduce or increase P² activities, including:

- Designating a pollution prevention coordinator
- Forming pollution prevention teams
- Setting goals for reduction or elimination of wastestreams
- Determining the true cost of waste generation, and
- Conducting periodic reviews to redefine and update goals.

During the course of this project, factsheets with information on developing a pollution prevention plan, and a guidance manual with suggestions on how to implement and sustain a pollution prevention program, were prepared. These documents have received widespread distribution throughout Illinois.

The Center's Research Program is funding Dr. Thomas Bierma as part of his project, "*Overcoming Barriers to Pollution Prevention in Small and Mid-Size Illinois Manufacturers*," to evaluate the guidance manual produced during the USEPA project (HWRIC Report TR-009). He will speak to companies that have used the manual to develop pollution prevention programs to learn how the manual did or did not help. Bierma will also identify a group of companies interested in pollution prevention concepts and considering developing programs for their facilities. He will offer them the manual to help with program development and implementation, then follow up to see if they found it useful. Recommendations for changes to the manual will be solicited and used to prepare a revised guidance document.

Two other USEPA-funded projects focus on non-hazardous industrial waste. In one project, HWRIC staff worked with engineers at foundries to reduce their waste through site assessments and suggestions for developing and implementing pollution prevention programs (see Chapter IV).

The second project required Center staff to analyze non-hazardous (Industrial-D) waste data contained in permit applications and manifest documents required by IEPA. Using these documents, HWRIC staff have identified 8,730 wastestreams that will be analyzed. Permits and manifests provide information on: the volume of waste that has been treated, stored, or disposed; the company or facility that generated the waste; and, the composition of the various wastestreams.

The final report for Dr. Bierma's study will list the barriers to pollution prevention program development and ways to overcome them; it will be available in early 1995.

HWRIC's computerized hazardous ranking program (the Degree-of-Hazard System, described in Chapters III and V of this report) is being used to further analyze the data for quantitation of the risks the wastes pose to human health and the environment.

All of these data will be used to define a prototype database for Industrial-D waste that can be used nationally. One of the critical steps in the development of this database is the definition of a waste classification system that will be applicable to Industrial-D waste nationwide. Toward this end, HWRIC has integrated existing classification systems from several states and incorporated them with what is already available for Illinois. Reports for both of these Industrial-D projects will be submitted to USEPA in December 1993, and should be available from HWRIC in early 1994.

HWRIC's Laboratory Services Program (LSP) has also received financial support to conduct research that addresses existing environmental problems. One contract was with the US Army Corps of Engineers Construction Engineering Research Laboratory (CERL) in Champaign to evaluate the toxic potential of aircraft washing activities at military bases. It was believed that these activities resulted in the killing of sewage treatment plant bacteria. HWRIC worked with CERL to study the toxicity of the substances used in the washing procedures.

Concentrations of the cleaner surfactants (linear alkylbenzene sulfonates) were determined in the washing solutions. LSP staff developed liquid chromatographic techniques to identify the surfactants listed as primary ingredients in the washing solutions. Toxicity was determined using the standard Microtox procedure, which measures the decrease in bacterial luminescence that occurs due to the presence of toxic constituents in the sample and converts this measure to a toxicity rating. Preliminary results for the washing wastewater indicate that it is somewhat more toxic than the similarly diluted washing solutions, which implies that some component other than the surfactants in the wastewater is responsible for killing the sewage treatment bacteria.

A second US Army Corps contract, with the Waterways Experiment Station (WES) in Vicksburg, MS, explored existing methodologies for evaluating what species (forms) of toxic metals exist in contaminated soils. This research impacts clean-up of metal contaminated soils at sites nationwide. The form of the metal found in the contaminated soil can affect both its toxicity and the remediation method required to restore the site to an acceptable condition. The existing methods used to determine which species are present involve selective extraction of the soil to remove specific metal fractions.

The WES-sponsored project rigorously evaluated the selectivity of this existing extraction procedure. Model soils were spiked with different metal isotopes. Using the Center's inductively coupled plasma/mass spectrometer (ICP/MS) to analyze these samples, LSP staff were able to distinguish between the slight mass differences of the isotopes.

A report on the surfactant project is available from the HWRIC Clearinghouse:
"LAS: Aquatic Toxicity and Biodegradation," (Report TN 93-029).

This new approach of employing isotopes and analysis by ICP/MS has facilitated the evaluation of the extraction process so that extraction conditions necessary for achieving the desired selectivity have been defined. Better characterization of the soil contaminants can be achieved and the most appropriate remediation method adopted.

During FY'93, the Center received financial support from the Illinois Environmental Protection Trust Fund to continue studying the problems associated with the manufacture and use of paint. The goal of this continuing effort is to develop the educational materials that were recommended by researchers from Research Triangle Institute and Research Associates in their report, "*Paint Waste Reduction and Disposal Options*," which documented the findings of a 1992 study mandated by the Illinois General Assembly.

Three reports, all available from the Clearinghouse, cover HWRIC's work on the legislatively mandated paint waste study: "Paint Waste Reduction and Disposal Options": "Executive Summary" (TR-007), "Volume I: Report" (RR-060), and "Volume II : Site Visits" (TR-008).

As part of the current paint waste project, factsheets are being prepared on the topics of:

- Paint selection, use, and disposal for homeowners
- Waste reduction methods for surface preparations, paint applications, and paint removal
- Lead paint toxicity, and
- Regulations for small businesses.

A science packet for kindergarten through sixth grade that focuses on paint and color is planned. Painting operations have been visited and pollution prevention successes are being documented. One such case study that explores the benefits of converting from conventional painting operations to powder coating is in review. Center staff are working with schools, extension programs, industry associations, retailers, and realtors to prepare materials that their students and clients will use. The project continues through FY'94. Factsheets are in preparation and should be available by spring 1994.

D. Research Supported Through Program Interactions

Center staff must often respond to an immediate need of a Center-funded researcher or a technical assistance client. In general, these activities are considered part of the individual's role as a member of HWRIC's staff. This type of support activity is essential to providing timely and knowledgeable responses to requests for help. Literature searches are necessary beginnings for all research, and are provided by Center Information Services staff for external clients as well as for HWRIC staff members. Databases are developed by Center Data Management staff, and the data they contain used to study trends in waste production and management, to identify industries in need of assistance, and to provide information on historical waste practices. Pollution Prevention staff routinely explore process modifications and new technologies to respond to the requests for help that they receive.

Laboratory Services staff frequently must refine existing methods and define new ones to characterize the complex environmental and industrial samples they receive. All of the Center programs work with and complement each other performing segments of research efforts that are ultimately combined to solve waste problems.

One research project that exemplified HWRIC program collaboration reduced oil and grease waste at a metal fabrication operation. HWRIC engineers visited the company and examined the existing cleaning operation. The parts received by the company are covered with oil to minimize corrosion during shipping, handling and storage. The oil must be removed before metal coating can begin, so some kind of cleaning operation is needed. The company had an aqueous phosphotizing system in operation, and routinely skimmed the oil from the top of the cleaning bath. After several months, a bath would become too contaminated and was disposed of and replaced with new solution.

HWRIC engineers proposed installation of an ultrafiltration unit to remove the oil contaminant from the bath so that bath quality would be maintained and for a longer period before disposal would be required.

To define the success of this bath rejuvenation effort, analysis of the contaminants (oil and grease) in the cleaned bath was needed. This analysis was difficult, due to the presence of the surfactants (cleaning agents) in the bath. Additionally, the conventional oil and grease analytical method uses freon — an expensive, ozone-depleting solvent — for the extraction steps, and does not separate the oil and grease contaminants from the cleaning surfactant.

LSP staff developed a method that employed solid phase extraction followed by selection elution with small volumes of organic solvents (not freon).

Once this separation was achieved, the oil and grease fraction could be analyzed by either gas chromatography or infrared spectroscopy, and the surfactant fraction could be analyzed by liquid chromatography with fluorescence detection. This methods development work verified the bath rejuvenating capabilities of the ultrafiltration process which was ultimately incorporated as part of the cleaning line. The facility reduced both its wastes and costs.



FIGURE 5-6: THE ULTRAFILTRATION UNIT, SET UP IN HWRIC'S PILOT LAB

E. Research for FY'94

In the coming year, many of the projects just discussed will conclude (see Table 5-3, page 5-4) and their results will be published and made available from the HWRIC Clearinghouse. But, several other projects are just beginning. Table 5-4 on the following page lists the new HWRIC-sponsored projects for FY'94.

Some of these FY'94 studies will continue to investigate treatment, remediation, and disposal techniques. Included in this group are:

- Field assessment of air sparging as a viable remediation technology
- Continued investigation of biodegradation and bioremediation of heavy metals
- Assessment of the bioavailability of soil lead, and
- Evaluation of some factors that may effect landfill liner performance.

Four other projects focus on waste reduction. Two will investigate new industrial coating technologies designed to reduce wastes at their source. Another will develop an adsorption/regeneration system to recover toxic organic compounds for reuse. The purpose of the fourth waste reduction project is to develop a manual for students and environmental professionals that explores pollution prevention opportunities for chemical processes.

The Center-conducted research studies described earlier in this Chapter will be completed in FY'94, but several new externally funded efforts have just begun. Some of the new projects include:

- Identification of pollution prevention information providers in the US and Canada Great Lakes region, and recommendations for better cooperation and collaboration
- Pilot of regulatory assistance provision to owners of Class V injection wells in Peoria and Tazewell counties
- Collaboration with the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) to assist their industrial clients with source reduction efforts, and
- Testing of alternatives to ozone depleting solvents used to clean parts.

Research efforts by HWRIC staff and HWRIC-supported scientists will continue to address the most urgent needs of the state. New projects build on the knowledge from previous studies to answer questions that still remain, and to explore new and better solutions to those that appear to be solved. Although much has already been learned, new and improved waste management options must still be identified and tested. Center research activities will continue to seek and promote effective techniques and technologies to eliminate or at least reduce wastes, to restore contaminated areas, to reduce health and environmental risks, and to increase industrial productivity.

TABLE 5-4: NEW RESEARCH PROJECTS

New Projects for FY94

Title	P.I./Affiliation	Project Duration (Years)
Treatment, Disposal and Remediation		
Toxic Heavy Metals in Biodegradation and Bioremediation Technologies	Niederhoffer & Koropchak/Southern IL University @ Carbondale	2
Air Sparging Investigation at Mattison Machine Works, Rockford, IL	Davis/Fehr-Graham and Associates	1.5
Influence of Cation Exchange Capacity and pH on Bioavailability of Lead in Soil to Rats	Buck/University of Illinois @ Urbana-Champaign	2
Effect of Chemical Immersion on Interface Strengths of Hazardous Waste Landfill Liner Systems	Stark/University of Illinois @ Urbana-Champaign	2
Waste Reduction		
Field Testing of In-Situ Phosphatizing Coatings	Chhiu-Tsu Lin/Northern Illinois University @ DeKalb	.8
Development of an Environmentally Safe Conversion Coating System for Magnesium	Owen Briles/Sundstrand Aerospace, Rockford, Illinois	.8
Pollution Prevention for Chemical Processes: A Handbook with Solved Problems from the Refining and Chemical Processing Industries	Allen & Rossetol/University of CA @ Los Angeles	.75
Development of an Activated Carbon Fiber Adsorption/Regeneration System to Recover and Reuse Toxic Organic Compounds	Rood & Larson/University of IL @ Urbana-Champaign	2

Chapter VI: Internal Resources Development

A. Introduction

Continual development of resources and capabilities is critical to the efficient operation of a service organization like the Center. Internal resources are important factors in the quality and quantity of services provided to the businesses and citizens of Illinois. During FY'93, areas of resource development included staff training, new analytical instrumentation, and expansion of computerized tools to make fiscal and information operations more efficient.

B. Laboratory Capabilities Development

The Laboratory Services Program (LSP) completed acquisition of laboratory equipment with remaining capital funds (Capital Development Board and Build Illinois funds) during the fiscal year. Instrumentation acquired included a gas chromatograph/Fourier-transform infrared spectrometer which enhanced our organic analytical capabilities. Organic contamination of soil and wastewater is a serious problem in parts of Illinois. This new chromatography/spectrometer, when used in conjunction with other laboratory installations, facilitates the identification of organic contaminants. This process allows the lab to better characterize a pollutant problem and establish a foundation for evaluating the effectiveness of remediation technologies.

With equipment acquisition essentially complete, the LSP renewed its attention to staff development. Vendor-sponsored training was provided for selected lab staff on several analytical instruments during the fiscal year, despite severe constraints on travel funds. Such training provides critical enhancement to HWRIC's capabilities to apply instrumentation to a wide variety of analytical problems, and ensures that the state's investment in this instrumentation is fully realized.

The LSP made an important commitment to quality in FY'93 through the addition of a new staff position - the Research Liaison/Quality Assurance Officer. Under the guidance of the RL/QAO, new procedures have been instituted to improve the laboratory's response to clients. The RL/QAO provides a single contact point for clients to provide information essential to the analytical process, and to receive information on the progress of their samples through analytical processing. The RL/QAO has restructured and solidified the framework for the laboratory's quality assurance program, and has been instrumental in developing documentation and procedures to put this program into practice.

An outgrowth of these efforts is that a new sample analysis request procedure was instituted over the course of the year. A list of prices for lab analytical services accompanied the introduction of the new request procedure. These enhancements to lab operating protocols are intended to improve the interface between clients and the analytical staff, and should result in better service to clients. The sample analysis request procedure also aids internal job tracking and accounting functions of the program.

C. Information Resources Development

1. Article Citation Database

In January 1993, the Center began developing an article citation database, implemented using the INMAGIC program that is already used for the Library and Clearinghouse databases. The Information and Laboratory Services Program staff cooperatively designed the database and the procedure for implementation. The purpose of the citation database is to enable staff to easily search citations and retrieve articles from HWRIC's Library or HWRIC staffs' collections that cover topics relevant to all aspects of the Center's efforts. The database is a comprehensive citation bibliography of articles from journals and proceedings, complete with article abstracts, and is searchable by an effectively unlimited number of keywords. The citation database enhances HWRIC's information resources by providing staff with access to the most current articles in the hazardous waste and pollution prevention fields. A part-time employee was hired to expand and maintain the database. Two hands-on training sessions for the citation database were presented to all staff.

2. Mailing Outreach Database

The Mailing Outreach Database (MOD) computer program was created in-house during FY'91 to provide flexible, easy-to-use, network access to various Center mailing lists. It is used for projects ranging from proposal solicitations to Governor's Award Program mailings, to report announcement packets. The database has a number of access points to the records, including name, company, zip code, HWRIC service function, and organization group. In FY'92, the MOD was enhanced to include a subsection for tracking of research proposals, projects, and peer reviewers, as well as mailing lists of investigators and reviewers.

In FY'93, further modifications were made to the MOD to extend its capabilities and correct previous technical problems which had limited its usefulness. A redesign of the data structure was undertaken to provide a more efficient format for the program. The menu-driven user interface was significantly modified to increase flexibility of searching and sorting. In addition, the output formats were customized to match University of Illinois Mailing Center standards to allow for more cost effective production of mailings by using bulk services. These modifications have proven effective -- more staff have been using the MOD more often to streamline outreach contact efforts.

By the end of FY'93, the citation database had grown to 1,126 records and had dramatically improved timely information access and retrieval efforts at the Center.

3. Library and Clearinghouse Collection Development

Budget cuts significantly reduced the acquisition of materials for the Library collection in FY'93. Subscriptions to 17 journals were canceled, and book orders were reduced from previous years. Collection statistics for the Library resource appear in Table 6-1 below.

TABLE 6-1: HWRIC LIBRARY COLLECTION STATISTICS, FY'93

<i>HWRIC Library Collection Development Statistics, FY '93</i>			
<i>Type of material</i>	<i>Number added in FY '93</i>	<i>Collection size at end of FY '93</i>	<i>Percent change compared to FY '92</i>
Books	609	3,864	+16%
Journals and newsletters	18 (largely free items from other states' programs) (-17 cancelled)	271	+0.4%
Audio-visual items	14	74	+19%
Articles	1,126	1,126	+100%
Maps	0	~2,000	+0%

At the end of FY'93, there were 293 items in the Clearinghouse, 81 of which were HWRIC-produced reports, and 212 of which were items from other organizations for which HWRIC obtained distribution permission. During the year, updated editions of five non-HWRIC items were added to the Clearinghouse, and three items were verified as obsolete, and removed from the collection.

Two new peer-reviewed reports from research projects sponsored by HWRIC were added to the Clearinghouse for distribution during FY'93: *Rates of Microbial Dechlorination of Polychlorinated Biphenyls (PCBs) in Anaerobic Sediments from Waukegan Harbor* (Report RR-061), and *Ecotoxicological Evaluation of Area 9 Landfill at Crab Orchard National Wildlife Refuge: Biological Impact and Residues* (Report RR-062). The most important technical research report printed during FY'93 was the Center's pollution prevention guidance manual, *Pollution Prevention: A Guide to Program Implementation* (Report TR-009), which has been widely distributed (see Chapter III of this report for details.)

Four new technical research reports were added to the Clearinghouse during FY'93.

Seven new technical publications were added to the Clearinghouse, including three new pollution prevention factsheets:

- A companion to the guidance manual, "Implementing a Pollution Prevention Program" (TN93-025)
- A factsheet geared to households, "Safe Use and Disposal of Antifreeze"(TN93-026), and
- A factsheet covering the Center's Pilot Lab work with ultrafiltration, "Waste Reduction in Metal Fabrication"(TN93- 028).

Other new technical reports include a learning project guide, "Product Life-Cycle Analysis: Environmental Activities for the Classroom" (Report TN93-

TABLE 6-2: HWRIC CLEARINGHOUSE COLLECTION STATISTICS, FY'93

<i>HWRIC Clearinghouse Collection Development Statistics, FY '93</i>	
Research Reports added	2
Technical Research Reports added	4
Technical Reports added	7
HWRIC items in Clearinghouse - End of FY '93	81
Non-HWRIC items in Clearinghouse - End of FY '93	212
Total items in HWRIC Clearinghouse - End of FY '93	293

031), by the Center's Education Specialist, and a compilation of the HWRIC Library's pollution prevention materials (TN 93-030). See Table 6-2 for more detail on HWRIC additions to the Clearinghouse.

D. Special Waste De-listing System Development

The Degree-of-Hazard (DOH) System is a PC-based computer program that analyzes a wastestream, based on data from applications for waste generator permits, and assigns a quantitative "risk factor" according to the regulations adopted by the Illinois Pollution Control Board in 1990.

Section 808, Appendix B of the Illinois Administrative Code mandates Degree-of-Hazard analysis.

In FY'93, the DOH was modified and updated. Major new features in version 2.0 include:

- A context-sensitive user help system graphing of wastestream toxicity and environmental fate scores
- Enhanced data entry screens
- Additional reporting options and,
- Expansion of the DOH user's manual.

The DOH system has proved a very effective resource tool for companies that are working to "de-list" their wastes; that is, prove that the wastes are of low enough risk to human health and the environment to be removed from the requirements for Illinois special wastes. Once "de-listed," waste can be properly disposed of at a less costly waste disposal site. See Chapter III of this report for a discussion of this use of the DOH program.

The Degree-of-Hazard program is available on diskette from the Center for \$75.00, prepaid. During FY'93, 20 copies of the DOH diskette were distributed to companies in Illinois and other states.

E. Pollution Prevention Case Study Database Developments

The Waste Reduction Information Bibliography Input Program (WRIBIN) is a program for collecting pollution prevention case study and general literature abstracts. These citations are for inclusion in the U.S. Environmental Protection Agency's Pollution Prevention Information Exchange System (PIES), the United Nations Environment Programme's (UNEP) International Cleaner Production Information Clearinghouse (ICPIC), and HWRIC's Waste Reduction Advisory System (WRAS). All of these systems are now based on the USEPA's pollution prevention case study format. A WRIBIN user's manual was written by HWRIC Data Management staff, and the entire package of manual and program was released to the public in April, 1993. A copy of the format, instructions, and example abstract entries are included in WRIBIN. The program runs on IBM or compatible PCs and is available from HWRIC for \$50.00. The WRIBIN package has been distributed to representatives from other states' pollution prevention programs participating in PIES development.

F. Automated Purchasing/Accounting Project

HWRIC Data Management staff, in conjunction with Administration staff, have developed an internal automated purchasing/obligation tracking system to run on the Center's Local Area Network (LAN). The system includes several components, the first of which is the Electronic Blue Sheet (EBS, named for the paper form) that allows staff members to enter order requests for products or services from their office computers. Requests are electronically forwarded to managers for approval, and then are routed on to the Purchasing Agent and the Director. The main goals of the EBS are to increase fiscal staff's response

rate to purchase requests and to provide a more accessible log of purchases. The Purchasing Agent transmits EBSs into the Obligation Tracking System (OTS). The OTS allows the Business and Finance Manager to immediately charge an order, which allows for more up-to-date calculations of available funds in each of the Center's budget lines. The data are then downloaded into a program running under the Great Plains Accounting System, a network-based, multi-user account package that provides for detailed data manipulation as well as detailed tracking of orders.

The combined purchasing/accounting system will allow the Center to:

- Save money by more rapidly processing purchase orders
- Keep better track of supplies, so orders can be made before stock depletion and within a timeframe that allows for discount purchases
- Consolidate orders to maximize volume discounts and state contracts
- Pay vendors on a more timely basis and thus avoid interest penalties, and
- Provide timely and accurate fiscal reports to the Center Director and managers.

Most portions of the complex system were in operation by the end of FY'93; further refinements will be made during the coming year.

G. Consultants and Services Database

The Consultants and Services Database was developed to allow technical assistance and pollution prevention staff to better manage the information they gather on various environmental consultants and services. Frequently staff suggest consultants and services to businesses and industries that need those types of specialized responses. This information was kept in paper and spreadsheet files, which were difficult to access quickly, and thus were not good resources for ongoing technical assistance or even for more than one HWRIC staff member. This year, Data Management staff converted the consultants and services information to a multiple user network database with search and output functions, including form letters, mailing labels, or organization listings. Toward the end of FY'93, a mailing was sent to over 250 companies to validate their services in order to keep this database as accurate as possible.

H. Internal Support

1. Projects

A number of projects undertaken by the Center require enhancement of our waste databases, plus significant data retrieval and analysis. Following are two examples of such projects. The Critical Trends Project, described in detail in Chapter IV of this report, involves substantial updating of databases, and analysis of data to describe various waste management activities within the state, as well as data trends.

Another project, being undertaken for USEPA, involves the gathering and analysis of substantial solid waste manifest and permit data from both Illinois and Pennsylvania. A further description of this Industrial-D waste project can be found in Chapter V of this report. A major task for this study was the organizing and reporting of Illinois manifest data. The Industrial-D waste project was in progress at the end of FY'93 and will be continued to completion in FY'94.

A major task for the Industrial-D study was the organizing and reporting of Illinois hazardous waste manifest form data.

2. Computer Users' Support

Support of Center personnel's computer needs is a key responsibility of Data Management Section staff. A knowledgeable computer user group is important to the smooth and efficient operation of the Center, which is reliant on individual desktop PCs. Data Management staff assist users by providing information and support on resources such as:

- The Local Area Network (LAN)
- Word processing
- Document scanning
- Image processing and,
- Hardware modification and repair.

The time spent in these efforts can be substantial, as can the effort to keep current on the ever increasing amount of information in the field of computing. However, development of staff expertise in the application of computer and network resources to their tasks and projects will continue to expand the Center's capability to better serve its customers.

Chapter VII: Future Directions and Needs

A. Introduction

Through its nine years of existence, the Center has developed a strong support base in the Illinois industrial community. HWRIC staff have worked closely with special interest groups, in particular the state's environmental lobbies and industrial trade associations, to keep abreast of the concerns of each.

All of these interactions have helped the Center evolve to its current structure. Through these interactions, priorities and problems that impact on the health and welfare of the citizens of Illinois have been identified and incorporated, where appropriate, into the operating structure of HWRIC. The Center's associations with these various groups allow us to continually monitor our program's effectiveness, address its shortcomings, and adjust its activities to be more responsive to the needs of the state.

This responsiveness is directly attributable to the relatively small size of HWRIC and the dedication of our staff. As the Center's visibility within the industrial community has increased, so have the demands to help industry solve their various pollution-related problems. Unfortunately, with the budget cuts of recent years, the Center has not been able to fully respond to the increasing demands for help.

Many of the activities and services performed by HWRIC staff are of a continuing nature, so many of the efforts discussed in the previous six Chapters of this report will extend, in some form, into the new fiscal year.

Some Center activities will be enlarged or broadened during the next year in response to new legislation, and a third group will result in new programs developed in response to emerging state needs. All of these activities will be addressed in this Chapter. In some cases, shortcomings in HWRIC's ability to respond to needs, and/or program services that would benefit from additional resources, are discussed.

The Center has purposefully chosen to play a prominent role at the national level in pollution prevention-related activities that impact the state's industries.

B. Technical Assistance Efforts

The Center provides advice and assistance to industry in several important areas including:

HWRIC's technical assistance efforts are at the heart of our interactions with the Illinois industrial community.

- (1) Guidance on regulatory compliance
- (2) Assistance on pollution prevention program development, and
- (3) Support of research and development of pollution prevention alternatives.

Guidance on regulatory compliance generally takes the form of telephone or written responses to questions received. Occasionally HWRIC staff follow up with site reviews. Assistance on pollution prevention (P²) program development often involves site visits and discussions with industry staff on their specific problems and needs. On some occasions, HWRIC conducts in-depth engineering research and development projects in response to industry needs.

On such projects, HWRIC's pollution prevention engineers and/or laboratory staff work with industrial facility personnel, and occasionally with vendors of equipment, to evaluate pollution prevention or treatment alternatives for a facility's wastestreams. Some of the more prominent technical assistance efforts planned for the coming year are addressed in the following paragraphs.

1. Pollution Prevention Technical Assistance

In FY'94, program staff will continue to provide P² assistance to companies in Illinois. This assistance will entail:

- Helping companies develop and implement P² programs
- Visiting their facilities and conducting assessments
- Providing information and case studies on emerging technologies and strategies relevant to their waste management needs, and
- Following up with companies that have received recent guidance or awards from the Center.

HWRIC will focus in particular on companies in the Greater Chicago area. As part of a contract with the USEPA, the Center will work with the Metropolitan Water Reclamation District of Greater Chicago and the City of Chicago to provide on-site technical assistance to companies that discharge to District facilities. Workshops and seminars will also be conducted in this region with emphasis on the specific industrial processes of electroplating, metal finishing and solvent cleaning, as well as techniques for managing wastes associated with such processes.

Through the Center's USEPA-funded Pollution Prevention Incentives for States (PPIS) project, staff will concentrate on pollution prevention assistance to small businesses in the Southeast Chicago and East St. Louis areas. Specifically, the Center will be targeting companies that currently use solvents in

cleaning applications. The Center will provide information to these businesses and will conduct pilot testing of aqueous cleaners as an alternative to solvents for these companies (see Section 2 below).

HWRIC P² staff will continue to work with Illinois foundries through the Industrial-D Project, also funded by the USEPA. The Center will describe current pollution prevention efforts at these facilities and will provide assistance with classifying foundry sands for beneficial reuse. Staff will also continue to work with these foundries to develop and implement P² programs and to further identify waste reduction opportunities.

Over the longer term, HWRIC would like to expand technical assistance and technology development efforts. We have found that direct technical assistance can lead to the specific research projects that are needed before a company can adopt a new or modified technology. During the spring, 1993 legislative session there were discussions, as part of a "One-Stop Shopping Bill," of having HWRIC establish a Chicago office to enable us to better assist small businesses in the area. Although funding was not forthcoming, this type of support for one or more regional offices would help the Center better serve businesses throughout the state.

2. Engineering and Development Support

a. *Cleaning Solvent Substitution A Critical Issue for Illinois Business*

There are over 150,000 degreasers in operation in the U.S. that utilize solvents for parts cleaning. These solvents usually contain chlorofluorocarbons (CFCs) and other compounds that may cause damage to the atmospheric ozone layer. Production of these solvents is scheduled to be phased out in accordance with the federal Clean Air Act amendments by January 1, 1996. Therefore, many companies have only about two years to adopt alternative cleaning methods for their industrial processes.

Illinois' metal fabrication and coating industries are key players in the state's economy and are also major users of degreasing solvents. Representatives from these industries have been contacting HWRIC for some time in an effort to find alternatives to the ozone-depleting solvents that will still provide acceptable product quality. There is no universal "drop in" cleaning substitute for the solvents. Each substrate, contaminant, cleaning requirement, production rate, etc., is process-specific.

In response to this critical issue, HWRIC is developing a solvent alternatives testing apparatus in one of the HML treatability laboratories. This unit will have the capability to test a wide variety of cleaning products, equipment, and processes. Companies will be able to either send parts to the laboratory to have various cleaning options evaluated or, for extended testing programs, will be able to request that the pilot system be set up at their own facilities. Data obtained from this testing can then be used to develop cleaning options to be

More than one metal fabricator has even commented that, "if acceptable alternatives to the solvents cannot be found, [they] will transfer the cleaning and coating portions of [their] businesses out of the country."

Several companies have already committed to testing alternative cleaners in HWRIC's laboratory, once the testing facility is ready.

implemented at other industrial facilities. HWRIC has received a grant from USEPA (under the PPIS project, see Chapter V) toward providing this service to industrial participants over the next two years.

This project has engendered considerable discussion within HWRIC about the need to evaluate the environmental implications of some of the alternative cleaning solutions/techniques that will be tested in our laboratory. HWRIC may encourage University of Illinois researchers to conduct some of the treatment and toxicological studies necessary to complete such evaluations.

b. Additional Pilot Projects

HWRIC engineers will be working with representatives from numerous companies in FY'94 to help them implement pollution prevention practices and technologies. Arrangements for conducting pilot testing of alternative technologies have been tentatively scheduled with:

- General Electric of DeKalb
- Nichols Homeshield of Chatsworth
- Eco Finishing of Montgomery
- Oakgrigsby of Aurora, and
- Burlington Northern Railroad of Galesburg.

It is likely that projects will be initiated with other facilities as the year progresses. Some of these projects will be executed in the HWRIC Pilot Lab while others will be undertaken at the company's facilities. Wastestream problems to be addressed in these projects will likely include:

- Volume reduction
- Recycling of oily wastewater
- Paint waste minimization
- Heavy metal removal, and
- Solvent recycling.

c. Realistically Addressing Industry Needs

As awareness of the direct engineering support available from HWRIC grows in the Illinois industrial community, an increasing number of companies are approaching the Center with their problems. In some cases, generic solutions to their wastestream management may be appropriate. However, in many cases, a rigorous engineering evaluation of a given waste reduction technology on a specific wastestream is the best solution. But current staff and resource constraints limit HWRIC's ability to respond in-depth to more than a handful of industries each year.

Ideally, to address the perceived needs of the Illinois industrial community, HWRIC requires the resources to assemble a group of approximately 10 to 14

engineers and scientists that can, upon invitation, enter corporate facilities and efficiently perform waste assessments, identify pollution prevention opportunities and assist with testing and implementation of alternatives.

These staff members should have industrial experience and strong technical knowledge, and should be able to help companies find solutions to their problems. Some of these staff might be appropriately located in one or more regional offices to better serve our clientele. At present, HWRIC's state-supported industrial assistance/pollution prevention staff is limited to five people plus a manager to carry out these functions.

3. Small Business Outreach - "One-Stop Shopping"

Illinois, like many other states, has experienced a myriad of ever changing environmental regulations with which small and mid-sized businesses often have difficulty complying. Over 90% of the businesses in Illinois are small businesses (with less than 500 employees). Recent surveys and small business focus group meetings have confirmed that the main thing businesses need from government is environmental regulatory, safety and pollution prevention assistance. Businesses strongly prefer that this assistance be provided by non-regulatory agencies.

To address these needs, the *Business Assistance and Regulatory Reform Act* (Public Act 88-404) was signed into law by the Governor in the summer of 1993. This Act identifies the Department of Commerce and Community Affairs (DCCA) as a key contact for industry "shoppers." The Act requires DCCA to work through and contract with HWRIC to provide confidential on-site consultation audits that could help guide regulatory compliance and identify pollution prevention opportunities. Unfortunately, funding did not accompany the legislation.

Requests from small businesses for regulatory and pollution prevention assistance from the Center already exceed our ability to respond. The need is particularly acute for a proactive P² program to reach medium and small companies in Illinois.

HWRIC needs additional staff to more adequately respond to the ever-increasing interest in pollution prevention development by businesses all over the state. Considering that there about 45,000 chemical waste generators (primarily manufacturers, utilities, and service providers) throughout Illinois that could particularly benefit from HWRIC's pollution prevention services, additional staff could help expand our services to more businesses. In contrast, the State of Minnesota, with significantly fewer chemical waste generators than Illinois, has 16 technical assistance staff funded by a state fee on toxic air emissions.

Expansion of HWRIC's RRT matching grant program (see Chapters III and V) could also benefit industry. The RRT program provides funding to companies to undertake pollution prevention demonstration projects. Results of such

During the past four years, Illinois industry groups and environmental organizations have publicly stated that HWRIC's technical assistance staff should be increased to meet pollution prevention planning needs.

projects are published by the Center so that other companies might benefit. Currently HWRIC has about \$100,000 annually for this program. The funding level limits the number and size of projects that can be supported each year. This type of financial support is particularly needed by small and medium sized companies.

C. Industrial Affiliates Program

HWRIC, in conjunction with professors in engineering, chemistry, and closely allied disciplines at the University of Illinois, Urbana-Champaign campus (UIUC), is seeking industrial affiliates to form a partnership in order to promote pollution prevention and to identify clean technologies. Testing of technologies and processes to reduce waste will be conducted within HWRIC's laboratories, UIUC laboratories, or at industrial facilities. The economic and environmental advantages of these technologies will be documented and the information made available.

The goals of HWRIC's planned Affiliates Program are to increase the competitiveness of Illinois companies and to provide greater marketing opportunities for economically and environmentally advantageous Illinois technologies and products.

The Industrial Affiliates Program will provide Illinois industry a greater role in guiding the research and engineering efforts of the Center. At an annual affiliates seminar, participating companies will have an opportunity to learn more about past and current efforts at HWRIC and UIUC and to recommend future program goals and activities. Affiliates will be offered preferential access to HWRIC's Hazardous Materials Laboratory and to staff who are involved with the program at both the Center and UIUC.

Funds generated through an annual donation to the affiliates program would be used to upgrade or buy new equipment and to provide additional staff to address industry needs. HWRIC would like to be able to support three or four graduate students each year in engineering, chemistry and other appropriate disciplines. The students would assist HWRIC staff in our pilot and analytical laboratories conducting research related to industry's concerns. Not only would the Center be able to help more companies with this supplementation of staff support, but hands-on training of students in pollution prevention would be significantly enhanced. The additional staff would address, in part, some of the Center's staffing limitations discussed elsewhere in this Chapter.

D. Environmental Aspects of Technology Development

HWRIC has a significant role to play in technology development in Illinois, particularly in developing technologies for cleaning up environmental contamination as well as technologies that will result in a reduction of the volume or toxicity of wastes being produced. The latter are called "clean technologies" in Europe or "pollution prevention technologies" in this country. These may be new technologies, or old ones that have been modified to operate more efficiently and produce less waste. Because more work has been done on those technologies used to treat wastes and clean up (remediate) sites of contamination, the Center has focused its efforts recently on technologies that are

important for preventing waste in the first place. However, the Center will continue to support waste treatment studies that are significant to the state.

Pollution prevention technologies and techniques are significant because they can help companies operate more efficiently, save money, increase competitiveness, reduce wastes and reduce the liability from the generation of toxic wastes. As part of HWRIC's P² program implementation assistance, we examine facilities' new technologies or the modification of existing ones to reduce waste.

FY'94 will see expanded effort in the above areas. The proposed industrial affiliates program will provide greater contact with and support from industry, and will give industrial participants a more active voice in HWRIC's research efforts. The Center also proposes to make a more concerted effort at technology transfer. We will build upon the successful work with industries within the Valley Industrial Association (see Chapter IV) to reach other manufacturers in the state. And we will look at informing industries and legislators of successful case studies from other industries both within and outside of Illinois.

Another area where HWRIC can play an expanded role is in the promotion of clean technologies. Many companies are looking for new processes and chemicals that will produce less waste or waste of a lower toxicity. HWRIC's pilot testing capabilities will allow us to demonstrate the effectiveness of many of these new chemicals and processes, and in so doing, help to promote those that are most effective. HWRIC will continue to work closely with companies that market such technologies and processes, seeking wastestreams where such processes can be effectively applied. Illinois companies that can develop such "green" products and clean technologies should find a great potential for growth and will contribute to the addition of new jobs to the state.

E. Education and Training

We recognize education and training as a fundamental aspect of the Center's pollution prevention activities. It is critical to begin instilling in the managers and engineers of the future the basic tenets of pollution prevention. Once students graduate and enter the work force, they will be able to implement principles for conversion of businesses to cleaner production processes. They can then incorporate a pollution prevention philosophy into their companies at all levels such that environmental concerns become an aspect of each employee's job, and are not relegated only to the environmental department or regulatory manager.

At present, technical assistance tends to reach only a few of the people intimately involved with pollution prevention within a business organization. Continuing education and training seminars will help to broaden the base of the training effort from management down through the plant work force.

A recent HWRIC-sponsored study addressed technologies being used to remediate sites contaminated by leaking underground storage tanks. The resulting report (Report RR-065, available from HWRIC's Clearinghouse) has proven very valuable to those companies and consultants needing remediation technology information.

1. Education

In FY'94, HWRIC's educational outreach effort will be specifically targeted to Illinois' colleges and universities. Plans include publicizing and disseminating two university curricula projects currently under development through HWRIC's Research Program.

To best work towards environmentally sound future practices and policies, HWRIC's educational outreach should be greatly broadened.

One project will result in the development of a college level pollution prevention course for engineers. Currently, pollution prevention education, if presented at all, is included as a small part of other engineering courses. The materials developed for the pollution prevention course include problem sets, handouts, reading materials, and group projects.

The second project will produce four teaching modules on pollution prevention. Two of the modules are specifically designed for business students and two are for public health students. These modules will contain the same basic materials as the engineering pollution prevention course, but will be presented from the business or public health perspective.

With additional resources, HWRIC could develop pollution prevention and waste management curricula for middle and high school students. Periodic tours and specific scientific demonstrations and presentations could be conducted at HWRIC's facilities for these students. In addition, materials and/or presentations for engineering continuing education programs, sponsored by various Illinois colleges and universities, could be produced. Engineers already in the work force would then have access to updated or additional training opportunities in pollution prevention.

Educational outreach could also be directed toward Illinois environmental groups through the development of slide shows or videotape presentations on important waste management opportunities and related services that HWRIC can provide. These groups often serve as catalysts for positive environmental change both in their local communities and at the state level.

2. Training

During FY'94 and beyond, HWRIC's pollution prevention program will expand its networking with statewide business organizations including the Illinois Manufacturers Association, Illinois Retail Merchants Association, and State Chamber of Commerce. The intent of this outreach effort is to tie into these organizations' established meeting or conference schedules and request time on their agendas to present talks on pollution prevention and specific services available from the Center. This will expand HWRIC's ability to reach diverse business and manufacturing audiences with information regarding Center services.

In addition, HWRIC will be working with the Metropolitan Water Reclamation District of Greater Chicago by providing pollution prevention workshops for a variety of their industrial customers (see also Section B.1. of this Chapter). This will allow for development of presentations and written materials that could be used for similar industrial groups throughout the state.

HWRIC envisions developing and sponsoring additional workshops or conferences targeted at specific industries within Illinois that have the most to gain from instituting pollution prevention programs. These could be videotaped to continue building our library collection of materials addressing specific pollution prevention issues. The tapes would then be made available for loan to companies requesting such information.

F. Research Activities

Research represents another component of the Center's broad-based attack on the state's hazardous waste problems. HWRIC staff conduct and fund research and provide technical guidance to investigators. This section identifies future plans for some of the more visible aspects of the Center's research activities.

1. HWRIC-Sponsored Research

State support of hazardous waste-related research is essential to Illinois' future economic viability and environmental health. Research is the key to the state's long-term efforts to:

- Enhance industrial productivity
- Restore areas made unusable by contamination
- Reduce health risks to Illinois citizens, and ultimately,
- Improve the environment.

Although the Center's research budget has suffered substantial cuts in recent years, HWRIC continues to solicit ideas in priority research topics where the return on the research dollar is maximized. Research funding plans for FY'94 include continued emphasis on improved treatment technologies and innovative waste reduction and pollution prevention technologies.

Waste reduction and pollution prevention research efforts will be diverse in FY'94. One new project focuses on development of a new technology using activated carbon adsorption coupled with cryogenic vapor recovery to reduce factory toxic emissions and provide for reuse of materials at the source.

Air sparging is another new remediation technology that has been used successfully in cleaning up aquifers contaminated with volatile organics. A project will be initiated in FY'94 in Rockford to demonstrate this technology.

HWRIC-funded pollution prevention research has focused on curriculum development at institutions of higher learning; in FY'94 and beyond, we intend to expand our curricula activities to industry training.

Also in FY'94, a project will be initiated to develop a handbook targeted for industrial personnel and permit writers focusing on pollution prevention in permitting of hazardous materials. These research efforts coupled with other identified strategies will help the Center better promote the advantages of adopting pollution prevention concepts.

Research on biodegradation and bioremediation includes a continuing project to develop toxic heavy metal-resistant microorganisms for pollution abatement, and studies of bioremediation of pesticide contamination at agricultural retail sites.

Further assessment of health and environmental risks posed by toxic substances will be made through:

- Continued study of indoor air quality
- Evaluation of the long term effects of using fly ash as a soil supplement
- Development of bioassays to determine the health hazards of contaminated air and soil.

An earlier study examining the relationship between lead levels in soil, pets and humans will be expanded to determine the influence of physical factors on the bioavailability of lead in soil.

The Research Program rejects numerous promising proposals each year during the proposal solicitation and evaluation process. Some of this work is deferred to later years, while other projects of merit essentially die with the rejection. Obviously, increased research funding would enable the Center to support additional deserving projects, perhaps advancing the pace of important breakthroughs in pollution prevention or environmental remediation.

2. Database Development and Promotion

HWRIC's access to environmental databases and resources, its interactions with industry, and its computing capabilities provide opportunities for the Center to become a focal point for the collection and analysis of data on environmental issues affecting Illinois. HWRIC has the potential to assimilate information from a number of different sources, evaluate trends in waste management, quantify the implications of new environmental regulations or improved technology, and publish reports and articles addressing these topics. HWRIC needs to produce more publications which could serve to increase awareness about the environmental data services, research and information we provide.

The Center also needs to produce publications that could help the public and policy makers better understand how the activities of Illinois citizens relate to the environment.

In the coming years, HWRIC plans to use regulatory data such as the Toxic Release Inventory (TRI) and other information to measure Illinois companies' successes in pollution prevention. The TRI database will be used in the USEPA-funded PPIS project to identify companies and industries that would be likely candidates for solvent alternative evaluations (see section B.2. in this Chapter). The documented success of the solvent alternative project will be used to assess the impact cleaner technologies (such as the use of non-ozone-depleting solvents) will have on the environment.

The first edition of the Critical Trends Assessment Project (CTAP) report will be published in the winter of 1993/94 (see Chapter IV). CTAP gave HWRIC the opportunity to expand and utilize the kinds of waste data available in the state and to explore how this information can help answer questions about environmental issues. The topics addressed in the first CTAP volume, such as recycling, industrial waste generation, and landfills, now have updated data. Other topics like wastewater discharges and incineration, which were not discussed in detail in the report, will be added to our databases as more information becomes available. A goal for future editions of CTAP reports will be to incorporate the Center's Geographical Information System (GIS) capabilities to a greater extent, to provide a more visual representation of the identified trends.

HWRIC will use the CTAP report as a basis for future updates on various waste databases.

G. Service Functions of HWRIC

HWRIC provides a number of special services to its user community (see Chapter II). These include information transfer, industrial technical assistance, and laboratory analytical assistance. Some new activities planned in the information and laboratory analytical assistance areas are presented below.

1. Property Information and Similar Requests

The Illinois *Responsible Property Transfer Act* requires disclosure of the environmental condition of a site prior to a sale. The primary outreach that the Data Management Section provides to the public is responding to requests from consultants and other individuals involved with property transfer.

The potential exists for HWRIC to expand the volume of property transfer information requests processed and the types of information provided. During the past two years, these requests have been de-emphasized due to staffing and time constraints. As recently as FY'91, HWRIC staff responded to over 164 requests per year for property information. In comparison, and resulting directly in a loss of staff due to budget cuts, only 61 requests were completed in FY'93.

Additional resources and staff would allow HWRIC to expand the number of firms/individuals in the state that are aware of our services and, as a consequence, significantly increase the number of requests processed each year. Fees collected for services could be used to offset some of the costs to the state.

The addition of the Historical Hazards system complements HWRIC's information Base.

Beginning in the fall of 1993, HWRIC will be assuming responsibility for the Historical Hazards Geographical Information System (GIS) which was compiled by the Illinois State Museum. The primary users of the Historical Hazards GIS are firms involved with property transfers. This GIS system will potentially increase potential users' awareness of and demand for the HWRIC's services.

Resources permitting, HWRIC could further expand the types of information provided to people seeking property transfer information. Logical additions that would enhance HWRIC's response to such inquiries include database information on underground storage tanks (including leaking tanks), TRI facilities, sites of spills, and additional historical information not available in regulatory databases.

Data Management staff are well-positioned to provide property transfer information in the most useful, timely and consistent manner possible. Ultimately, this service could include one-day processing, automated responses, and the inclusion of a site map with each request. Information available in HWRIC's databases is needed by the public. HWRIC has estimated that, for an additional \$70,000 to \$90,000 per year, we could provide most potential users in the state with a responsive GIS database related to responsible property management.

2. Information Services to HWRIC and the State

In FY'94, the Information Services Program (ISP) aims to be more proactive in providing information to citizens and industries of Illinois. The program will be seeking new information delivery mechanisms. More opportunities for participating in collaborative outreach activities, such as the planned participation with other local groups in the American Chemical Society National Chemistry Week events, will be explored during FY'94. Collaborating with others on environmental outreach will increase HWRIC's visibility in the area and extend the program's limited staff. Such collaboration will also enhance HWRIC's support network and contacts.

The ISP plans to focus on more and better target media contacts as a first step in informing our potential clients that we have information available that may be of value to them. In the coming year, press releases on HWRIC reports and activities will be routinely disseminated, which should increase awareness of HWRIC resources throughout the state. The ISP will also be exploring improved ways of providing less technical pollution prevention information to communities, private citizens, civic groups and students. Attempts will be made to better coordinate outreach activities, such as group tours and other special functions throughout the year, with information events such as Earth

Day. The ISP plans to be more proactive in promoting HWRIC to legislators, particularly in informing them of efforts to provide waste management information assistance to the industries and citizens of their districts. This will be done through regular press releases and announcements.

In FY'93, significant strides were made in establishing a user-friendly computer database of journal article reprints. This database, as it continues to mature over the next year, will provide access for both HWRIC staff and visitors to a tremendous amount of current information on hazardous wastes, pollution prevention and related topics. The ISP will continue to rely on electronic resources and individualized service to provide HWRIC staff and clients with information critical to their jobs.

3. Laboratory Services

The Laboratory Services Program (LSP) provides support that will continue to impact the following groups over the next 12 months:

- (1) HWRIC-sponsored researchers
- (2) State and university researchers receiving funds from extramural sources
- (3) Industrial and other non-state researchers
- (4) Federal sponsors of work conducted by the LSP, and
- (5) HWRIC staff engaged in pollution prevention and engineering development projects.

The program will also continue to manage the research laboratories in the building, maintaining access to outside research groups needing quality space in which to conduct their projects.

The LSP will continue to explore opportunities to expand the analytical competency of its staff. Despite limited resources for travel and training, the program will identify critical training needs and ensure that these needs are addressed. Specific training on newer analytical systems will be supplemented by seminars and other low cost training sessions offered, usually in-state, by a variety of commodity and equipment vendors. Staff will also be encouraged to pursue opportunities to enhance their education and areas of expertise at the University of Illinois.

There is an immediate need to improve the analytical and technical support provided for the outreach efforts of the Center's programs. Staffing and, to some degree, resource limitations, prevent the establishment within the LSP of a separate "technical assistance support function" with staff and equipment dedicated to intra-Center efforts. In lieu of such a special support group, the Program will seek to identify ways of enhancing the communication and the sample analysis processes to better interface with other HWRIC programs.

Increasing involvement of Pollution Prevention Program and other HWRIC staff in direct assistance to industry will cause some shifting in priorities within the LSP.

In concert with its increasing concern for technical assistance support projects with industry, the LSP will seek to identify ways in which the considerable staff and equipment resources of the Program can be better brought to bear on industrial problems (such as the surfactants effort illustrated in Figure 7-1).



FIGURE 7-1: SENIOR CHEMIST TERESA CHOW AND LAB MANAGER DR. MARVIN PIWONI VIEW RESULTS OF HPLC ANALYSIS OF SURFACTANTS IN INDUSTRIAL PROCESS WATER.
(PHOTO BY JOEL DEXTER, STATE GEOLOGICAL SURVEY)

Program staff will be encouraged to get involved in project aspects beyond sample analysis, lending their technical expertise to sampling design, sample collection and handling, data interpretation, and other aspects of project conduct. The LSP will seek ways in which its special analytical capabilities might better serve the needs of industry.

Once these interfaces are identified, the Lab Program will strive to more effectively market its capabilities to outside clients through better education of those HWRIC staff who routinely speak before industrial and other groups throughout the state.

New research opportunities will be explored in concert with other HWRIC programs. As an example, the switch to new chemicals for the cleaning of oil from metal parts raises concerns about the potential impact of the new cleaners on the environment.

Experience has taught many times over that changes pursued in the interest of the environment invariably have unforeseen consequences of their own. By addressing such issues early, potential problem areas might be identified before technologies take hold, rather than after the environmental damage has been wrought.

As the implementation of pollution prevention technologies by industry increases, so will the opportunities to explore the environmental implications of such new technologies. Funding opportunities to support such studies will be pursued.

H. Summarizing Future Directions and Needs

Opportunities for HWRIC staff to work with the citizens, environmental groups, and businesses of the state continue to reveal new areas in which HWRIC could provide assistance in resolving pollution problems and spurring environmentally conscious economic growth. HWRIC responses to such needs continue to be a delicate balance between perceived priorities and limited resources.

The Hazardous Materials Laboratory offers engineering, research, and analytical support capabilities that are unique in state government. HWRIC continues to search for new and better ways to apply this substantial state resource to the pursuit of its mandates. It also seeks ways to collaborate with others to address the needs of its customers. And finally, HWRIC remains receptive to outside suggestions on how it can improve the services it provides to the state.

Each new fiscal year brings shifts in the focus of the Center, in part because of our sensitivity to our clients' changing needs. Direct technical support to industry, information transfer, and database interpretation and support will all evolve and expand over the coming year. To supplement available state resources, HWRIC continues to identify federal contracts and programs that are natural extensions to our goals in serving the citizens and industries of the state. HWRIC will implement several such contracts during FY'94, and will aggressively pursue new monies as they become available.

Appendix A: Fulltime Staff Publications and Presentations



Case, Laurie J. 1993. *Product Life-Cycle Analysis : Environmental Activities for the Classroom*. Champaign, IL: Hazardous Waste Research and Information Center. (HWRIC Technical Report TN93-031)

Drone-Silvers, Frances, and Sara Tompson. 1992. "Hazardous Waste Reference Resources." *Science & Technology Libraries* 13(2):65-74 (Winter 1992).

Chow, Teresa. 1993. "Characterization of Nitroaromatic Explosive Compounds by Particle Beam Liquid Chromatography/Mass Spectrometry." Poster Presentation at *205th American Chemical Society National Meeting* (Denver, CO, March 28th-April 2, 1993)

Kraybill, Daniel D. 1992. "Environmental Issues and Careers." Presented at Undergraduate Environmental Chemistry Class, Illinois State University (Normal, IL, December 8, 1992)

Kraybill, Daniel D. 1993. "Household Hazardous Waste." Radio Interview with University of Illinois News Bureau (Urbana, IL, April 23, 1993)

Kraybill, Daniel D. 1993. "Pollution Prevention Fundamentals." Presented as part of the *Solvent Reduction Teleconference*, February 11, 1993

Kraybill, Daniel D. 1992-93. "Pollution Prevention." A workshop presented at:
Abbott Laboratories, North Chicago
John Deere Corporation, East Moline, IL
Northbrook Chamber of Commerce, Northbrook, IL
League of Women Voters, Rockford, IL
Illinois Land Improvement Association Conference, Peoria, IL
Government Institutes Conferences(2), Chicago, IL
McHenry County Health Department, McHenry, IL
Greater Chicago [Pollution Prevention] Project Seminar, Chicago, IL
Textile Maintenance Institute of Greater Chicagoland, Chicago, IL

Kraybill, Daniel D. "Pollution Prevention in Parts Cleaning." Presented at Ill. Environmental Protection Agency *Partners in Prevention* Conference (Bloomington, IL, October 26, 1992)

Kraybill, Daniel D. 1992. "Potentially Infectious Medical Waste Regulations." Presented at University of Illinois, College of Veterinary Medicine (Urbana, IL, October 22, 1992)

Kraybill, Daniel D. 1992-93. "Small Quantity Generator Compliance Training" presented at:
Illinois Department of Transportation Compliance Workshops, Champaign, IL
IRMCO Seminar, Champaign, IL.

- Lindsey, T.C. 1993. "Pollution Prevention Case Studies conducted by the Hazardous Waste Research and Information Center." Presented at the Ill. Environmental Protection Agency *Partners in Prevention* Conference (Shelbyville, IL, October 26, 1992)
- Lindsey, T.C. 1993. "Pollution Prevention in Metal Fabrication." Presented at the IRMCO Seminar (Champaign, IL, April 6, 1993)
- Mendicino, Laura A. 1992. "Implementing a Pollution Prevention Program." Presented at the Ill. Department of Transportation Training Seminar (Champaign, IL, October 8-9, 1992)
- Mendicino, Laura A. 1993. "How to Do Pollution Prevention: A Guide to Program Implementation." Presented at the Air & Waste Management Association Conference, *Issues of 1993* (Chicago, IL, January 28-29, 1993)
- Mendicino, Laura A., Beth H. Simpson, Timothy C. Lindsey, Daniel D. Kraybill, and Gary D. Miller. 1993. "Introduction to Pollution Prevention for Regulatory Personnel." Presented at the two sessions of the Greater Chicago Project Workshop (Stickney, IL, April 27 and May 18, 1993)
- Miller, Gary D. 1992. "Basic Tenets of Pollution Prevention." Presented at the Chicago Metal Finishers Institute Workshop, *Pollution Prevention in Metal Finishing* (Elk Grove Village, IL, November 12, 1992)
- Miller, Gary D. 1992. "Economics and Quality Benefits of Pollution Prevention." Presented at the Central Illinois Section of the American Society for Quality Control Meeting (Springfield, IL)
- Miller, Gary D. 1992. "Environmental and Economic Benefits of Pollution Prevention." Presented at the Illinois Industrial Hygiene Association Meeting (Peoria, IL, May 7, 1993)
- Miller, Gary D. 1992. "Overview of Hazards and Toxics." Lecture at University of Illinois, Institute for Environmental Studies (Urbana, IL, September 15, 1992)
- Miller, Gary D. 1992. "Pollution Prevention in Aqueous Degreasing of Steel." Presented at the Nature of Illinois Foundation meeting (Chicago, IL, November 13, 1992)
- Miller, Gary D. 1992. "Preventing Waste in Paint Manufacturing and Paint Use." Presented at the Michigan Office of Waste Reduction Services *Pollution Prevention Workshop for Industry* (Grand Rapids, MI, October 6, 1992)
- Miller, Gary D. 1992. "Use of the Degree-of-Hazard Evaluation System for De-listing Special Wastes." Presented at Illinois Environmental Protection Agency, (Springfield, IL, July 23, 1992)
- Miller, Gary D. 1993. "Applied Technology Research and Technical Assistance Services." Presented at the Illinois Manufacturers Association Conference on Pollution Prevention (Naperville, IL, September 22-23, 1993)
- Miller, Gary D. 1993. "Economic Benefits of Pollution Prevention." Presented at the National Plant Engineering and Maintenance Conference (Chicago, IL, March 9, 1993)
- Miller, Gary D. 1993. "Pollution Prevention Assistance and Case Studies." Lecture at Sangamon State University (Springfield, IL, March 1, 1993)

- Miller, Gary D. 1993. "Pollution Prevention Assistance and Resources." Illinois EPA Summer Intern Training, at Illinois Institute of Technology (Chicago, IL, May 28, 1993)
- Miller, Gary D. 1993. "Pollution Prevention Case Studies." Presented at a Metropolitan Water Reclamation District of Greater Chicago meeting (Chicago, IL, May 18, 1993)
- Miller, Gary D. 1993. "Pollution Prevention and Product Quality." Presented at a meeting of the Central Illinois Section of the American Society for Quality Control (Springfield, IL, May 13, 1993)
- Miller, Gary D. 1993. "Pollution Prevention Services for Illinois Businesses." Presented at the Valley Industrial Association meeting (Geneva, IL, April 6, 1993)
- Morrow, Debra and Marvin D. Piwoni. 1993. *LAS: Aquatic Toxicity and Biodegradation*. Champaign, IL: Hazardous Waste Research and Information Center. (HWRIC Technical report TN93-029)
- Simpson, Beth H. 1992. "Printing and Pollution Prevention." Presented at the Ill. Environmental Protection Agency *Partners in Prevention* Conference (Shelbyville, IL, October 26, 1992)
- Thomas, D.L. 1992. "Economics and the Environment: Can we have both through pollution prevention strategies?" Presentation at the Illinois Environmental Council, 18th Annual Conference (Sangamon State University, Springfield, IL, October 17, 1992)
- Thomas, D.L. 1992. "Overview of the National Roundtable of State Pollution Prevention Programs." Presented at the U.S. Agency for International Development and the World Environment Center Pollution Prevention Meeting (Washington, DC, December 4, 1992)
- Thomas, D.L. 1992. "Overview of Pollution Prevention Requirements and Proposals". Presentation at Illinois Institute of Technology, Illinois Manufacturers Association and Ill. Dept. of Energy and Natural Resources. *Illinois Waste Reduction Meeting* (Wheaton, IL September 22, 1992)
- Thomas, D.L. 1992. "Pollution Prevention." Presentation at the Illinois Power *Customer Expo '92* (Decatur, IL, October 15, 1992)
- Thomas, D.L. 1992. "Promoting Pollution Prevention in Illinois." Presented at the U.S. Agency for International Development and the World Environment Center Pollution Prevention Meeting (Washington, DC, December 4, 1992)
- Thomas, D.L. 1992. Participant in Clean Air Act Panel, Executive MBA Business and Government Day, Sponsored by The Executive MBA Program, UIUC and the Taxpayers Federation of Illinois. (Urbana, IL, November 13, 1992)
- Thomas, D.L. 1992. Participant on expert panel on state pollution prevention programs at U.S. General Accounting Office Meeting (Washington, DC, December 11, 1992)
- Thomas, D.L. 1993. "Overview of State Activities." Part of panel on Advancing Pollution Prevention: Local, State, and Federal Activities. *Pollution Prevention: Widening the Circle* Conference, Sponsored by the National Academy of Sciences Conference Center (Woods Hole, MA, June 17, 1993)

Thomas, D.L. 1993. "Pollution Prevention at the State and Federal Level." Presented at *Working Together to Manage Waste for Environmental Progress* (Chicago, IL, June, 8, 1993)

Thomas, D.L. 1993. "Pollution Prevention and State Resources." Presentation at Department of Defense Environmental Forum, (Atlanta, GA, January 27, 1993)


Thomas, D.L. 1993. "State Initiatives in Pollution Prevention." Presentation at Second Annual Air Force Worldwide Pollution Prevention Conference (San Antonio, TX, June 1, 1993)

Thomas, D.L., G.D. Miller, J. Peden, and T. Lindsey. 1993. "Pollution Prevention Research at the Hazardous Waste Research and Information Center" Pages 589-602. IN *Proceedings of the Sixth Annual Environmental Management and Technology Conference/Central*.

Thomas, D.L., et al. 1993. "Pollution Prevention Research at the Hazardous Waste Research and Information Center. " in *Proceedings of the Sixth Annual Environmental Management and Technology Conference/Central* (Rosemont, IL, March, 1993)

Tompson, Sara, compiler. 1993. *HWRIC Library Holdings in Pollution Prevention - 1993*. Champaign, IL: Hazardous Waste Research and Information Center. (HWRIC Technical Report TN93-030)

Wasson, Patricia, Sara Tompson and Frances Drone-Silvers. 1993. *Three State Agency Libraries Combine Expertise to Make Natural Resource and Environmental Information Available*. Poster presented at Illinois Library Association Annual Conference (Springfield, IL, April, 1993)



*Sixth Annual
Governor's
Pollution Prevention
Awards*

Award and Certificate Winners

*Award Ceremony
December 7, 1992
Fairmont Hotel
Chicago, Illinois*

Sixth Annual Governor's Pollution Prevention Awards

Community Organizations



Piatt County Farm Bureau - Monticello, IL

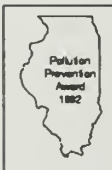
Piatt County Farm Bureau is a not-for-profit organization which serves the needs of the Piatt County farming industry. The organization, in conjunction with IEPA, conducted a county-wide used tire collection. Members handled publicity of the event and staffed the collection. Over 5,000 tires were collected and taken to ADM in Decatur to be used as alternative fuel.



Village of Rantoul - Rantoul, IL

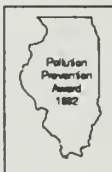
The Village of Rantoul has established an extensive recycling program covering glass, aluminum and steel cans, newspaper, and cardboard. A yardwaste composting program is also provided for its citizens. The village publicizes the program and provides education on recycling to all citizens.

Trade Organizations



Chemical Industry Council of Illinois, Inc. - Rosemont, IL

The Chemical Industry Council of Illinois (CICI) is a trade association made up of 117 member companies. CICI promotes pollution prevention among its member companies in Illinois through various activities. They conduct various educational programs for both industries and schools. They also support the USEPA 33/50, Partners in Prevention, and Responsible Care programs.



American Foundrymen's Society - Des Plaines, IL

The American Foundrymen's Society is an organization which addresses the needs of the foundry industry. As part of their waste reduction efforts, AFS supports research to investigate beneficial reuse of foundry sands and other wastes.

Vendors



Chicagoland Processing Corporation (CPC) - Mount Prospect, IL

CPC is a silver reclamation firm which has developed and patented a system to reclaim silver from polyethylene terphthalate (PET)-based photographic (X-ray and lithographic) film using enzyme digestion. No cyanides are used in the recovery process as was the industry standard prior to their method. The silver recovered is used to mint commemorative sports coins (they are licensed by NBA, NFL, NHL, NCAA, and Major League Baseball). The remaining film components are shipped to Eastman Kodak for reuse in new film. CPC handles film primarily from printers and hospitals.



First Brands Corporation - Alsip, IL

First Brands packages antifreeze in plastic containers which they manufacture. First Brands has replaced their lead-chromate color concentrate with a non-heavy metal concentrate. The bottles now contain no heavy metals which may allow them to be more easily recycled by the consumer.



Toppert Sales & Leasing, Ltd. - Hillsdale, IL

Toppert has developed a separation system, FAT-PAK II, for evacuating grease traps at food establishments and separating the useable components. They are looking at reuse applications for the grease such as animal feed, lubricating oils, alternative fuels, and amino acids.

Small Facilities (1-150 employees)



Justrite Manufacturing - Mattoon, IL

Justrite manufactures containment systems for flammable and other hazardous materials. For safety can products, they replaced their solvent-based spray paint line with powder coating. This reduced their paint-associated waste and their volatile organic compound emissions from this line by 100 percent. They also achieved a higher quality paint finish and improved worker safety. By investing in the powder coating system they not only reduced disposal costs, but also reduced operating costs (higher quality, less rework and reject), reduced energy costs for make-up air, and reduced clean-up and liability costs. Their 1992 activities will include installing a powder coat system for their safety cabinet line and eliminating vapor degreasing.



Hevi-Duty Electric - Mount Vernon, IL

Hevi-Duty Electric, in one of their processes, generates PCB contaminated debris from the remanufacture and decommissioning of electrical distribution equipment. To address this problem, they formed a waste prevention team known as RWASTE - Reducing Waste At Source Til Elimination.

nated. The team was able to reduce the amount of contaminated debris by using a number of approaches including: installing a water/oil filtration system to separate the PCB-contaminated oil; conducting awareness and identification training for PCBs and other wastes; compacting drums; and modifying containment equipment. They also established a waste tracking system based on the number of units processed through the facility. This system allows them to measure the actual waste reductions achieved during varied processing times and conditions. In 1991, a 50 percent waste reduction was achieved with only a \$3,200 investment.



DAP, Inc. - Rosemont, IL

DAP manufactures adhesives and caulk. Previously, they generated quantities of waste from mixer cleaning between batches - specifically, chlorinated solvent waste from cleaning mixers after solvent-based recipes were made. DAP now cleans the mixer after the batch is mixed using the same vehicle solvent (water, toluene, or chlorinated solvent) as was used in the batch. The cleaning material is then drummed and saved until the next batch of the same product is run. This is then used as the vehicle solvent. Initiating the system involved some schedule rearranging but resulted in a savings of >\$40,000 in avoided disposal and raw material replacement costs. DAP also has other various recycling activities involving drums, pallets, paper and cardboard, waste oil, and pails.



Henry Pratt Company - Aurora, IL

Henry Pratt manufactures rubber seated butterfly valves. In their process, they used vapor degreasing as a pre-vulcanizing cleaning process. Tetrachloroethylene was used in the degreaser. Henry Pratt eliminated vapor degreasing by combining a higher heating temperature with an alternative bonding cement while still achieving acceptable vulcanization criteria. This step has eliminated their major emission source and has enabled them to withdraw their vapor degreaser operating permit.



Fluid Power Systems - Wheeling, IL

Fluid Power Systems manufactures hydraulic valves. Their activities include reducing fugitive emissions from their vapor degreaser, prolonging the coolant life in machining operations, and implementing a paper and cardboard recycling program. The fugitive degreaser emissions were reduced by 23 percent through modifying the transport control system (moves baskets between tanks) to reduce disturbances. They prolonged coolant life by switching to a synthetic coolant and installing an oil skimmer to remove tramp oil.

Medium Size Facilities (151-500 employees)



Nichols-Homeshield, Inc. - Chatsworth, IL

Nichols-Homeshield, a metal parts fabricator, conducted several pollution prevention activities. They formed a problem solving team with employees from the punch press department to eliminate the use of a methylene chloride-perchloroethylene solvent mixture. The team determined

that a caustic water solution could clean the drop outlets effectively and safely thus eliminating waste disposal and raw material purchase costs for the solvent. Labor costs were also reduced. Another activity was the reduction of coolant application by installing a misting application system to eliminate the need to flood the products with coolants. Management worked with the employees to implement this project. The result was reduced disposal and coolant costs and also improved product quality and reduced down-time necessary to clean out coolant. They also replaced petroleum naphtha solvent with a non-toxic cleaner and began purchasing other cleaners in bulk to eliminate drums. NH has management commitment including an environmental steering committee which encourages employee involvement teams to improve quality, reduce waste and respond to environmental concerns.



The Interlakes Companies, Inc. - Pontiac, IL

By working with their paint supplier, Interlake eliminated heavy metals (lead and chrome) from their paint while maintaining the high quality finish. This reduced disposal cost (non-hazardous paint filters) and improved worker safety. They also improved general operating practices in the paint department and thus generated 90 percent less paint waste. In the die shop, chlorinated solvents were eliminated by substituting non-hazardous cleaners. Employees received training in order to understand the reasons and benefits for the change. This cleaner substitution and subsequent employee training resulted in no cleaning waste for disposal. Overall, plant disposal costs were reduced by \$189,000 or 79 percent.



National Castings, Inc. - Melrose Park, IL

National Castings, a steel foundry, replaced two 1,1,1-Trichlorethane-based products used in their sand core coating process with a water based product known as Velvaplast. A laboratory technician worked with a vendor, Ashland Chemical, to identify the new product. This resulted in 100 percent elimination of 1,1,1-Trichloroethane, a chemical listed on USEPA's priority list of 17 chemicals.



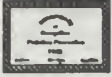
The Marvel Group, Inc. - Chicago, IL

The Marvel Group manufactures office equipment. They have replaced their high solids paint system with powder coating. This has eliminated both volatile organic compound emissions and waste paint sludge from overspray and solvents. It also improved product quality as powder coating provides a higher quality, more durable finish. They also replaced vapor degreasing with a five stage washer system. In addition, the Marvel Group decided to discontinue using an outside source who used hexavalent chrome to electroplate chrome and zinc parts. Instead they found a chrome-colored powder coat to use in-house. They also recycle scrap steel, office paper, and cardboard.



Eagle Wings Industries, Inc. - Rantoul, IL

Eagle Wings manufactures automobile parts. They have established small teams of employees who meet regularly to improve production and address pollution prevention. Some activities include switching to a new type of paint with 40 percent lower volatile organic compounds and reduced metal scrap production by reducing the size of sheet metal blanks. They also recycle packaging materials and metal scrap.



North American Lighting, Inc. - Flora, IL

NAL previously used Freon in a sonic cleaning process. They found an inexpensive alternative - high pressure air blasts. NAL achieved a savings of \$200,000 by eliminating the purchase of Freon on an investment of \$30,000 for the air blast system.

Large Facilities (> 500 employees)



Navistar International Transport - Melrose Park, IL

Navistar has established a Source Reduction Committee made up of members from every business unit of the plant. This team established goals to reduce volume and toxicity of wastes, obtain environmentally acceptable raw materials, implement recycling programs, etc. The team then targeted streams for reduction due to volume, toxicity and cost. They developed a plan to address each of five streams. Team members worked with their coolant vendor to develop a new coolant containing no diethanolamine - their number one Toxic Release Inventory reporting chemical. They also worked with their paint manufacturer to eliminate the use of methyl ethyl ketone in their paints. Navistar installed a coolant repolishing unit to reduce coolant waste and replaced Stoddard solvent with non-hazardous cleaners in part washers. They also implemented an office recycling program. In addition to these activities, Navistar has developed a smokeless diesel engine to be on the market in time to meet the 1994 Clean Air Act regulations for diesel vehicles.



Chrysler Corporation - Belvidere, IL

Chrysler's Belvidere facility implemented several pollution prevention projects. They increased the usage of galvanized sheet metal in the car body thus eliminating the need for zinc-rich primer. This eliminated both volatile organic compounds from and disposal of this primer. By reworking the application system and educating employees on pollution prevention, they reduced their waste from underbody deadner application by 85 percent. The use of vinyl glue was also eliminated by using new headliner pads with a pre-applied pressure sensitive adhesive. This also eliminated the waste disposal and VOC emissions associated with the glue. Paint booth wastes and emissions were greatly reduced by switching to water washable coatings and strippers, remasking equipment cabinets, and employee education. Management is committed to reducing waste and providing skill and awareness training for employees.



CCL Custom Manufacturing, Inc. - Danville, IL

CCL is a contract packager of liquids and aerosols. They have a strong commitment to reducing waste and improving quality. Operating in a continuous improvement culture administered by the Danville Steering Committee, CCL encourages extensive employee involvement. Several continuous improvement "breakthrough" teams are established to address specific areas. These teams are made up of employees of all levels from different areas of the plant. Not only do the teams address waste reduction and quality improvement but also production and changeover time (and associated waste from clean out). Recent accomplishments include scrap reduction, drip and product loss reduction, improved warehouse and inventory system, and waste tracking. Employees are very much involved in their waste reduction efforts with scrap being tracked and translated into cost for the employees to see.



Imperial Bondware Corporation - Shelbyville, IL

Imperial Bondware manufactures thermoformed plastic products. They have established a Total Quality Management process known as The Quest of Excellence Thru People. Several employee task force teams participated in recycling and source reduction projects. An extensive recycling program was established for virtually all solid waste. The paper cup leak test was modified by installing a vacuum leak test. Now only one cup is wasted for every eight cups previously wasted. The hazardous materials used in their processes have been reduced from 23 to 1. They have also substituted water-based inks for solvent-based ink for printing on polyethylene coated paper, an industry first. The facility tracks the amount of waste, solid waste or trash, generated per unit produced to effectively measure waste reduction. Imperial Bondware has achieved a savings of \$67,000 through reduced waste disposal and material usage.



Eaton Corporation - Lincoln, IL

Eaton manufactures electrical breakers and enclosures for residential and industrial use. The facility replaced their liquid paint dip system with an electrostatic powder coating system. This reduced waste in several ways. The multi-stage wash and pretreatment was modified since the more durable powder coat eliminated the need for the zinc phosphate and chrome seal pretreatment steps. A new iron phosphate and non-chrome/deionized water rinse wash system is now used. Excess paint waste, consisting of drip and run-off collected on papers, has been eliminated. There is no overspray waste with powder coat as overspray is reused. Spray booth water waste has been eliminated. Volatile organic compound emissions have also been eliminated and product quality has improved.



Motorola, Inc. - Schaumburg, IL

Motorola established a team of employees, known as the Green Team, to address their packaging material problem. Motorola estimated that approximately \$50 million per year was spent on packaging material, most of which was eventually landfilled. The Green Team focused on source reduction techniques to redesign packaging in order to reduce the amount of packaging material used in Motorola products and to implement packaging reuse programs between facilities. The team also worked with vendors and suppliers to provide their materials in reusable containers. In addition, the team prepared packaging guidelines for the Motorola employees involved in product packaging. Cost savings are expected to exceed \$5 million.

Appendix C: Research Project Summaries



A. Research Projects Completed in FY'93

Enhancement of the Degradative Potential of Microbial Isolates Enriched from Herbicide-Contaminated Soil

*Alan Felsot and Charles Vossbrink, Illinois Natural History Survey
E. Kudjo Dzantor, Tennessee Valley Authority*

Several strategies have been used for the development of microbial decontamination of high-levels of herbicides in soil. While some success has been achieved with microbial decontamination of liquid waste streams, decontamination of soils has been more difficult to achieve. To develop a microbial-based technology that is suitable for decontamination of pesticide waste, researchers are enhancing the degradative abilities of several microbial strains isolated from herbicide-contaminated soil. Those cultured strains can then be used to aid clean-up of herbicide contaminated soil resulting from spills and rinsing procedures. The final project report will be available in early 1994.

Use of Landfarming to Remediate Soil Contaminated with Pesticide Waste

*Alan Felsot, Illinois Natural History Survey
James F. Frank, Andrews Environmental Engineering*

Soils contaminated with pesticide waste at agricultural retail facilities in Illinois need immediate cleanup to prevent further degradation of water quality and pollution of nearby residential property. Remediation of the soil by

landfarming may provide an economical and effective solution. Project objectives are to:

- 1) remediate pesticide waste by excavating contaminated soil and landfarming it on cropland;
- 2) determine effects of loading rates on the degradation of landfarmed pesticides;
- 3) determine the effects of biostimulation with organic nutrient amendments on landfarmed pesticides;
- 4) determine the effects of landfarming on the quality of surface runoff and shallow ground water;
- 5) assess toxicity of waste-treated soils, runoff, and leachate; and
- 6) develop environmentally sound technical criteria for landfarming of pesticide-contaminated soils. A report will be available in early 1994.

Speciation and Mobilization of Toxic Heavy Metal Ions by Methanogenic Bacteria

Eric Niederhoffer and John Koropchak, Southern Illinois University at Carbondale

Investigators are examining toxic heavy metal contamination at Crab Orchard National Wildlife Refuge by studying the activity of methane-producing bacteria. Methanogenic bacteria synthesize methane from hydrogen and carbon dioxide. They are responsible for 80% to 90% of the biogenic methane found in the atmosphere. This project focuses on the importance of methanogens for mobilizing cadmium, lead, and mercury in the environment. Studies underway address the growth of these bacteria in the presence of these metals and the capability of sequester-



ing agents, cell wall components, and intracellular proteins to solubilize iron complexes with these metals from a variety of phases. The project final report will be available in late 1993.

Automated Database Tracking of Chemical Usage at the University of Illinois at Urbana-Champaign (UIUC)
John Abelson and Jerry Fisk, University of Illinois at Urbana-Champaign

This project has developed and tested a computer database system to track the inflow, inventory, and disposal of chemicals in research laboratories at UIUC. A personal computer can be used to log in all substances entering a laboratory. Chemical users may then search the database to learn which chemicals are already available. The system is designed to facilitate waste minimization through:

- 1) a reduction in duplicate and excessive purchasing of laboratory chemicals;
- 2) the internal recycling of unused chemicals; and
- 3) the fostering of improved waste disposal practices within the university community. Implementation of the tracking system should lead to more efficient use of chemicals and less waste chemicals being generated. The computerized tracking system will be made available to other universities in Illinois. The program and user's guide will be available in early 1994.

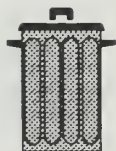
Evaluation of Methods for Tracking and Reporting the Presence of Special Waste from Commercial Sources
Judith Freeman, Solar Environmental Services, Inc.

An unspecified amount of special waste is being disposed in municipal and commercial solid waste streams and landfilled. It is not easy to quantify these materials because of difficulty in differentiating special waste by quick visual inspection. This project will

examine the use of bar-coding to track special wastes in mixed solid waste loads and pilot a field application of the technology on established commercial routes. The report for this project is being reviewed and should be available by late 1993.

Use of Char for Management of Paint Processing Waste
Carl Kruse, Illinois State Geological Survey

This project is a cooperative undertaking between the Illinois State Geological Survey (ISGS) and Ford Motor Company that originated from mutual interest in carbon materials which adsorb or absorb organic molecules from air and/or water. Ford Motor Company is interested in controlling emissions from painting operations. The ISGS is working to develop an alternative to burial or incineration for paint sludge by creating a char from the sludge that can be used to remove particulate volatile organic compounds from air and water in their painting operations. The ISGS has made high surface-area carbon material from coal char with both sorptive and catalytic properties which have proven to be very efficient in removing organic emissions. Paint sludge char and mixtures of coal char and paint char have been tested with the mixture showing the more promising sorptive capabilities. Final testing is underway at Ford. A final report describing the project and its findings should be available in early 1994.



B. FY'93 Projects Continuing in FY'94

Categorizing Major Waste Streams in Foundries

Daniel Twarog, American Foundrymen's Society, Inc.

The purpose of this project is to characterize foundry waste streams that result in air emissions. Organic compounds are emitted during core-making, pouring, and shake-out, while inorganic compounds are emitted from furnace melting operations. A literature review is being completed, and a database is being compiled of foundry contacts, Material Safety Data Sheets, and process operating parameters. The project will identify technologies to treat, recycle, or dispose of the identified wastes. The ultimate objective is to provide data to support the industry position in negotiating standards for emissions of compounds listed by USEPA in the Clean Air Act Amendments. The final report will be published by early 1994.

Measurements of Indoor Toxic Volatile Organic Compounds (VOC) Concentrations Attributed to the Residential Storage of Household Storage of Hazardous Waste

*Clyde Sweet and Stephen Vermette, Illinois State Water Survey
William Rose, University of Illinois Building Research Council*

Indoor air quality is often worse than outdoor air quality. This problem is attributed to the numerous products and building materials used in residential and commercial buildings. The problem of higher concentrations of pollutants indoors is compounded by length of exposure — Americans spend about 90% of their time indoors. The storage of leftover or excess household hazardous waste within a home may contribute to the deterioration of indoor

air quality. The purpose of this study is to examine the extent of contamination and the effect of toxic vapors emitted from common household chemicals, such as automotive products, pesticides, paints, and solvents. Many of these materials contain benzene, carbon tetrachloride, methylene chloride, and other volatile organic compounds (VOCs). VOC levels measured in an experimental home indicate that substantial levels can be attained, particularly in areas with open containers and little ventilation. VOC levels are being measured under a variety of conditions in the experimental house. Later, experiments will be conducted in occupied homes. The project final report will be published in June 1994.

Impact of Fly Ash Disposal on Plant Development

A. Lane Rayburn, University of Illinois at Urbana-Champaign

The purpose of this project is to determine the effect of fly ash disposal on plant development. As utilities continue to burn coal to produce electricity, vast amounts of fly ash are being produced as a waste byproduct. Studies have indicated that use of fly ash in strip mine reclamation and agriculture land amendment would help alleviate problems associated with landfill disposal of fly ash; however, little information exists regarding the long-term subtle effects that such uses could produce. Long-term exposure to levels of toxic chemicals (like those in fly ash) too low to induce toxicity may have subtle effects on the genetic material contained within the plant nucleus. This study is examining nuclear DNA and cell cycle parameters in corn to quantify the subtle effects of fly ash on plant development. This three-year project is scheduled for completion in June 1995.



Recovery and Recycle of Metals from Industrial Wastewater by Adsorption on Iron-Coated Carbon

Paul Anderson, Illinois Institute of Technology

Dr. Anderson has evaluated an iron oxide-coated carbon adsorption for the removal and recovery of metals from industrial wastewaters. The study:

- 1) evaluated the coating process and characterized the adsorbent;
- 2) determined adsorption characteristics of the solid compared to several model adsorbates;
- 3) determined the operating parameters for a column adsorption process; and
- 4) compared the composite adsorbent to traditional ion exchange process. The results indicate that iron oxide-coated granular activated carbon performed well as a composite adsorbent for the removal of low levels of copper from solution and that it can be used to remove and recover copper from solution. The adsorbent was not as effective at removing chromium. The final report will be published in late 1993.

An Investigation of Column Flotation Technologies for the Pretreatment and Volume Reduction of Contaminated Soils and Sediments

Joseph FitzPatrick, Northwestern University

Soils may be contaminated by improper waste disposal, leaking underground storage tanks, accidental chemical releases, and runoff from industrial, agricultural, or disposal areas. Treatment technologies for contaminated sediments include stabilization, vapor extraction, bioremediation, solvent extraction, soil washing, and vitrification. Remediation processes are often integrated to achieve effective treatment. This adds to the time, effort, and cost of remediation. This project is investigating a column floating technology that would separate the fine frac-

tions of low- to moderately-contaminated soils and sediments from cleaner ones, effectively reducing the volume of soil requiring further treatment. This would reduce the time and cost of remediation. This project continues until June 1994.

LUST Groundwater Technology Report

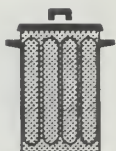
Timothy J. Wolterink, Sr., Perino Technical Services

This investigation will identify the basic free product recovery and ground water cleanup strategies that are currently being accepted by the IEPA. The groundwater remediation technologies include, but are not limited to: conventional "pump-and-treat," bioremediation, and aquifer aeration (also known as aquifer air sparging). Information will be gathered on the characteristics of each technology, data required for design of cleanup systems, effectiveness and suitability of various soil types and contaminants, and cost, where available. In addition, the final report will include a section discussing regulatory and permitting requirements that are applicable to ground water cleanups in general, and where applicable, to individual cleanup technologies. The project final report will be available in spring 1994.

Identifying Site Specific Limitations to Successful In-Situ Bioremediation of Agrichemical Retail Sites

Michael A. Cole, University of Illinois

The purpose of this project is to develop a battery of tests to identify site-specific limitations to bioremediation at several Illinois pesticide-contaminated agrichemical sites. The results will be a protocol for others to use to identify limitations at other sites. The test will define the physical, chemical, and biological properties of the contaminated sites and compare them with the



properties of adjacent uncontaminated areas. Site variability will also be evaluated with respect to these properties. A complete report will be available in late 1994.

Effect of Chemical Immersion on Interface Strengths of Hazardous Waste Landfill Liner Systems

Timothy Stark, University of Illinois

Landfills still receive the majority of the hazardous and solid waste generated in Illinois, and will probably continue to do so for many years. As a result, new landfills must be sited and built to accommodate new waste, and old landfills need to be covered. Recognizing that leachates from industrial and municipal solid wastes may be as damaging as those from hazardous wastes, the EPA proposed subtitle D regulations that recommend the use of soil-geosynthetic liner systems for solid waste landfills. The integrity of these liners can be compromised by physical and chemical factors. This study will test the effect of chemical immersion on the peak and residual strengths of both soil-geosynthetic and geosynthetic-geosynthetic liners. Results of this research will have an important impact on practitioners, researchers, manufacturers, and governmental licensing agencies involved with the design and permitting of soil-geosynthetic liner systems for hazardous and solid waste impoundments in Illinois. This project report will be available in summer 1995.

Treatment of Spent Chemical Oxygen Demand Solutions for Safe Disposal

Thomas R. Holm, Illinois State Water Survey

Analysis for chemical oxygen demand (C.O.D.) is routinely performed at wastewater treatment operations. This research will develop a method for treating spent C.O.D. solutions which contain toxic metals. As a result of this

treatment, concentrations of Hg and Cr will be reduced by at least 99%, which will greatly reduce the loadings of Hg and Cr from laboratories performing C.O.D. determinations. The method will be rapid and convenient. A final report is anticipated in summer 1994.

Stabilization of Arsenic Nonwastewaters

Robert Fuessle and Max Taylor, Bradley University

In 1984 the Hazardous and Solid Waste Amendments to RCRA were signed into law requiring USEPA to promulgate regulations for treating hazardous wastes before land disposal. EPA has declared vitrification the best demonstrated available technology (BDAT) for arsenic-containing wastes because it effectively treats a variety of these wastes. Given the limitations of vitrification, i.e., it is energy intensive and creates potential air quality concerns, stabilization may be a desirable alternative treatment for arsenic wastes. The goal of this research is to develop a stabilization process that will treat arsenic nonwastewaters in a cost-effective and volume-efficient manner. Investigators will study arsenic speciation in waste, a mix and design matrix with a stabilizing agent, and deterioration of the stabilized cement product. An economic analysis of the best stabilization procedure will also be made. The project is scheduled for completion in late 1993.

Course in Pollution Prevention

Paul Anderson, Illinois Institute of Technology (IIT)

This project will introduce the dynamics of waste minimization to engineering graduate students. The course will concentrate on pollution prevention concepts in an industrial setting such as waste reduction techniques, development of "clean" technologies, and case



studies of successful programs. The one semester course will first be offered to students at IIT majoring in Metallurgical, Electrical, Civil, Chemical, Mechanical and Environmental Engineering in the Spring of 1994. A report that will include the course description, study plan, and materials will be prepared. This project will be completed in summer 1994.

Development and Pilot Demonstration of a Computerized Bar-code-Based Waste Tracking System for Waste Minimization at Argonne National Laboratory

Robert Peters, Argonne National Laboratory

This project combines the use of process waste assessments with a barcode-based waste tracking system. It will identify significant areas for waste reduction at Argonne National Laboratory (ANL). The development and implementation of a computerized bar-code waste tracking system will enable ANL to track Argonne's hazardous wastes and will facilitate the waste chain-of-custody from the point of generation to ultimate disposal. ANL's Energy Systems Division has been selected for a pilot demonstration of the system. The report detailing the effectiveness of the system will be available in early 1994.

Pollution Prevention and Business Management: Curricula for Schools of Business and Public Health

Thomas J. Bierma, Illinois State University

This project will result in four curriculum modules for use in graduate and undergraduate schools of business and public health. The modules are designed to present a management orientation to industrial pollution prevention with particular emphasis on Total Quality Management (TQM) and its implications for pollution prevention.

The modules will be developed using literature as well as field experiences. A project report is anticipated in June 1994.

Waste Management Survey of Illinois Higher Education Institutions

Diane O'Rourke, University of Illinois at Chicago

The objective of this project is to conduct a survey of waste management policies and practices of Illinois institutions of higher education. Participants will be asked to respond to questions regarding the personnel responsible for solid/hazardous/other waste management on each campus, and the structure under which those persons perform their duties. In addition, the survey will gather detailed information about the institutions, their waste management programs and generation sources, and their need for assistance. This project is scheduled for completion in June 1994.

Technology Transfer to Aid Pollution Prevention and Waste Management
Edward Lakner, University of Illinois at Chicago

A survey of manufacturing firms in Illinois will be conducted to determine their research and information needs related to pollution prevention and to gather information about the application of waste reduction technologies in Illinois. The survey results will assist HWRIC in translating available technology into specific applications for manufacturers. Survey data and a report will should be available in summer 1994.



Overcoming Barriers to Pollution Prevention in Small and Mid-Size Illinois Manufacturers

Thomas J. Bierma, Illinois State University

This project will not only identify the barriers to pollution prevention in small and mid-size manufacturers in Illinois, but also propose means of overcoming those barriers as developed by the manufacturers themselves. A variety of survey and problem-solving techniques will be used, including telephone interviews, focus groups, and site visits. Based upon the results of the problem-identification phase of the study, "solution groups" comprised of representatives from small and mid-sized manufacturers will develop strategies for overcoming pollution prevention barriers. A report will be available in late 1994.

An Analysis of Municipal Solid Waste Reduction Opportunities in Industrial/Commercial Distribution Networks
Matthew Snyder, Community Recycling Center, Inc., Champaign, IL

The objective of this study is to develop a program for reducing, reusing, and recycling waste from industrial packaging and transport in the manufacturing/distribution/retail chain. The study will focus on the distribution network for consumer products, primarily food and grocery distribution. It will also execute a pilot program for reducing, reusing, and recycling waste at a distribution facility. A complete report will be available in summer 1994.

Determination of Animal Hazards from Air and Soil Samples from Crab Orchard

Larry Hansen, University of Illinois at Urbana-Champaign

This project proposes use of bioassay methods for hazard identification, hazard characterization and dose-response assessment of various matrices associated with the PCB-laden landfill in Crab Orchard Refuge. The site is on the Superfund National Priorities List. This project will provide an animal hazard ranking, based on multiple biological endpoints, for a specific set of samples known to be contaminated with PCBs. A final report will be available in summer 1995.

Household Pets as Sentinels of Lead Exposure

William Buck, University of Illinois at Urbana-Champaign

The purpose of this study is to evaluate the merits of using dogs and cats as monitors of environmental lead exposure to humans. This research is being conducted at the site of a former lead smelter (NL Industries/Taracorp) in Granite City, in conjunction with a national study of the environmental impact of lead on human health. Data collected to date have shown no statistically significant effect of lead concentrations on the blood parameters examined in the dogs and cats. However, the data have shown some interesting relationships between blood lead concentrations and blood serum that may clarify mechanisms for known side effects of chronic lead exposure. Correlations between human health data and pet data will be included in this portion of the project. The project final report should be available in late 1993.





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